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CONTENTS.

Editorial 511
Visit of Germans to Schenectady..... 514
The Pay of British Telegraphers..... 514
Investigation of New York Lighting Companies..... 514
Our New Home 515
Recent Electrical Development in Europe..... 516
New French Regulations as to Use of Electrical Power in Factories.. 517
Current News and Notes..... 517
The Kaministriquia River Power Developments..... 519
Abnormal Primary Current and Secondary Voltage on Placing a Transformer in Circuit. By Tyrgve Jensen..... 521
Electrical Developments in Argentina. By Lewis R. Freeman..... 523
Electricity in Peru 525
A Year's Operation of the Highest Working Voltage in the World.. 528
Direct-Current Turbo-Generators..... 529
Prevention of Sparking in Alternating-Current Commutator Motors.. 529
New Telephone Patents..... 530
LETTER TO THE EDITORS:
Standardization of Scientific Notation. By J. P. Nikonow..... 531
Digest of Current Electrical Literature..... 532
Switchboard Connections of Wattmeters and Watt-Hour Meters for Measuring Power and Energy in Polyphase Circuits. By Paul MacGahan 536
New Type of Incandescent Lamp..... 539
Lectures on Illumination 539
The Canadian Electrical Exhibition..... 540
Commutator Truing Device..... 541
Commercial and Financial News..... 542
General News 544
Weekly Record of Electrical Patents..... 549

MUNICIPAL OWNERSHIP VERSUS PRIVATE OWNERSHIP.

The report of the municipal ownership commission of the National Civic Federation, to which allusions have recently been made in our columns, promises to be a valuable although a somewhat lengthy publication in its completed form. The gist of the committee's conclusions has already been printed in our issue of Aug. 3. Although those conclusions are not unanimously subscribed to by the members of the committee, yet it is remarkable that substantial agreement should have been reached upon so large a subject by 20 men representing not only business interests, but also labor unions, education and the press. There is no social question of greater importance at this time than that of municipal versus private ownership. There is no larger question than this, and certainly no question which admits of a greater range of opinion. At one extreme viewpoint of this subject are the believers in despotic authority and in universal ownership by divine right of kings. At another extreme viewpoint are socialists favoring the abolition of all private property. Somewhere between autocratic dictatorship and communistic possession, all modern communities strive to find a stable equilibrium.

Since the great coal strike of two years ago, public opinion in the United States has indicated marked opposition to the continuance of private ownership of public necessities on the same terms as previously existed. To many persons, a solution of the difficulties of social and commercial aggregation seemed to be obtainable by Governmental operation of all utilities. The report of the National Civic Federation calls attention, however, to some of the dangers which beset municipal omniownership. We can well believe that under certain conditions the remedy might be worse than the disease. If we consider, for instance, the electric lighting and power supply of a large city, we know, from experience, that this is a business calling for trained management and operation. The best of judgment and direction are needed for the proper conduct and development of the business. The best at the head and the most intelligent cooperation in every post and department are needed for the most successful operation of this complicated service. The report points out that municipal ownership can only be expected to be successful when the conditions in a city are such as will bring into the service of the city the most energetic, most faithful and best trained specialists for each post in the service. Up to the present time, however, general experience in American municipal affairs has not shown a tendency to attract the most fit and loyal servants as a class, although many honorable individual exceptions to this rule have presented themselves. Until, therefore, public affairs in our cities have so changed that better and more reliable men can be organized for highly complex technical public service, such as electric supply, than a private corporation can enlist, it will be to the public advantage to continue private ownership under suitable regulation, rather than to attempt dangerous quests for Utopia. Publicity of management by private individuals can be trusted to accomplish better results than the privacy of management by

public officials. We fully endorse the recommendation of the committee, that full publicity should be required of the accounts of private companies under a uniform system of accounting.

Diffuse Lighting.

There seems to be at present, as we have noted within the past few months, a reactionary sentiment as regards lighting by diffuse reflection from ceilings by means of lamps concealed in coves or other devices. The necessity for suppressing too bright sources of light and of getting to moderate intrinsic brilliancies has unquestionably led to some very crude attempts at diffuse or indirect lighting, the effects of which have been bad. A reaction from these wasteful designs is natural and necessary. In an interesting paper before the Illuminating Engineering Society Convention at Boston, Mr. Preston S. Millar pointed out some of the sources of inefficiency in diffuse lighting. The points made against it were that too large a percentage of light is absorbed by the ceiling and walls; that there is a loss due to unnecessary intensity at unimportant points; and that with ceiling and walls lighter than the working plane, the eye requires a higher intensity on the working plane than when the ceiling and walls are less brilliantly illuminated than the working plane. It is evident from the figures given relating to the cove lighting in the convention hall in the Boston Edison Building, that to those elements of inefficiency which Mr. Millar mentioned should be added another which is often of more importance than all the rest combined, namely, bad design. In other words, most of the diffuse lighting systems that have been so far tested accurately were of inherently inefficient design. We wait with much interest the complete figures promised on the Boston Edison installation mentioned where the design is evidently such as to greatly reduce the elements of inefficiency mentioned by Mr. Millar. The Boston Edison installation is designed so that a large proportion of the light is reflected only twice before reaching the working plane, which is a much less number of reflections than is frequently found in diffuse lighting. The size of the reflecting surfaces is also small enough so that the necessity of abnormally high illumination on the working plane is not felt, since so small a portion of the ceiling is used for diffusing that the greater part of the ceiling and sidewalls are not abnormally light.

There can be little doubt that where economy is the controlling factor in the design of illumination and all other considerations are thrown to the winds, the plan of furnishing a mere ground-work of general illumination, reinforced where necessary and nowhere else by localized light, furnishes the largest working illumination for the least money. In certain cases this is undoubtedly the best procedure, yet it is not always desirable or convenient. In fact, it is usually inconvenient where large numbers of lamps must be dealt with, as in large offices and industrial establishments. In spite of its inconvenience, it may be the only feasible method. Where general illumination is wanted in all of the room, diffuse lighting comes into consideration as one of the possible methods. It is yet too early to predict the outcome. We think the possibilities of diffuse lighting have not yet by any means been fully thrashed out. There must always be loss in diffuse lighting due to diffuse reflection. For instance, a beam of light coming from a lamp equipped with a reflector must inevitably suffer loss by reflection from anything whatever, yet this loss is of determinable amount and is not greatly in excess of that which has to be met in cases where the source of light must be screened to lower the intrinsic brilliancy. The beam of light in question may readily be reflected with a loss of no more than 40 or 50 per cent, while an opal or other globe to reduce the glare might lose 20 or 30 per cent. The very great loss in indirect lighting which Mr. Millar quotes as 70 per cent or so, is clearly due mainly to improper design. Incidentally, we may remark that in his direct lighting Mr. Millar apparently used bare lamps, which in most places where diffuse lighting would be used are inadmissible, while frosted lamps, when used, suffer very severely in useful life.

A very interesting and curious feature of the paper of Mr. Millar is found in the tests to determine how much higher intensity of illumination was required for reading in a room lighted with indirect lighting than with direct lighting. The diffuse lighting system with which this room was equipped should certanly serve as an example of how not to attempt diffuse lighting, the walls being excessively light with diffuse reflection from the lamps, the ceiling being dark and the sources of light being denied the privilege of reflectors. A string of bare lamps around the wall, for instance, would have tended to the same result as far as reading is concerned. We understand, of course, that these bad conditions were selected purely for the purpose of showing by an extreme case the possible magnitude of some of the adverse factors in diffuse lighting, and the results were therefore of value. It should not, however, be taken as representing the best that can be done with diffuse lighting. This class of lighting probably offers a wider opportunity for technical skill in its design than any other familiar method. But it certainly is not to be condemned at this stage of the game on the strength of some of the blunders that its advocates have made in the past. It is a good thing, however, to have some of its failings brought home to us.

Abnormal Conditions in Transformer Operation.

That a momentary rush of primary current takes place upon connecting an unloaded transformer to its mains has been previously recognized, and it is known that this rush of current is affected by the residual magnetism of the transformer core. Attempts to measure this excessive current having given erratic results, the determination of its precise nature was made the subject of a special investigation in the electrical laboratories of the University of Illinois, the results of which are outlined in an article by Mr. Tyrgve Jensen, elsewhere in this issue. It was found that under uniform conditions of previous magnetization of the core. the closing of the primary switch at a predetermined definite point on the supply e. m. f. wave gave uniform results. Changes in the point of wave at which the closing took place made a definite change in the rush of current in the primary, and changes in the previous magnetism of the core had a definite effect, although less pronounced. It was found to be impossible to connect the primary of a transformer to the supply mains without producing from 6 to 16 amperes of current momentarily, in a transformer whose normal exciting current is only 1.5 amperes. Excessive initial secondary voltages also were always obtained, but their values varied from about 10 to about 30 per cent above the normal, the most abnormal values of primary current coinciding with the

least abnormal values of secondary voltage when the switch was closed at the zero of the supply e. m. f. wave. Furthermore, the secondary e. m. f. values were not appreciably affected by any previous magnetic condition of the core, showing that the laws governing the primary current values differ from those governing the secondary e. m. f.

The oscillograph curves accompanying the paper show that the impulsive rush of primary current is practically unidirectional, being maintained almost exclusively upon one side or the other of the zero current line, depending upon the value and direction of the residual magnetism of the core at the moment of closing the switch. It has often been assumed that sluggishness of iron in becoming magnetized is the cause of the primary rush of exciting current in a transformer. The experiments seem to show that this theory is fallacious, since the oscillograph records prove that the secondary e. m. f., which must depend upon the core magnetism, may assume a normal value coincident with entirely abnormal values of primary current. In suggesting methods for the operation of high-tension transmission lines these experiments may prove of value, since they indicate a way for the bringing into service of a large transformer unit without shock to the system. When the coils of a transformer are connected into circuit, it is evident that a large rush of current may occur, possibly causing a dangerous surge. The experiments show that when a reactance coil is placed temporarily in series with an incoming transformer, just as a resistance is placed in series with an incoming direct-current motor armature, excessive primary current and secondary e. m. f. may be restricted. Such a method of "synchronizing" a transformer before fully connecting it directly to the supply circuit would seem to promise good results in the operation of large units.

EUROPEAN METHODS OF OPERATING MOUNTAIN RAILWAYS ELECTRICALLY.

It is evident on studying a relief map of Europe, that Switzerland has nearly secured a corner, or monopoly, of the mountains of the central European area. This topographical peculiarity, together with the acquired national propensity of the Swiss to be the model hotel-keepers of the world, has developed the electric mountain railways with particular advantage in Switzerland. The electric energy for these railways is obtained by a seeming inversion of the second law of thermodynamics—that is, by working from a lower temperature to a higher, or by the water falling from the melting mountain glaciers above the snow line, to the more genial temperature of the valleys. Two essentially distinct systems of operating the mountain railways are in use, the direct-current system and the alternating-current system, the latter being the more generally used, and the three-phase system the most popular. A mountain electric railway differs from an ordinary electric railway in two salient particulars. First the gradient is usually about 20 per cent, so that a rack and pinion method of propulsion takes the place of the ordinary wheel-to-rail contact friction method; and secondly, elaborate precautions are necessary for converting the motors into generators when descending these steep grades. When the direct-current system is used, the motors are converted into generators during descent by the weight of the falling train of cars, and a large, specially ventilated wire resistor is provided on the electric locomotive for absorbing the energy from the generators. In this way the speed of descent of the train is kept down to five miles an hour on the 20 per cent grade, without the application of mechanical brakes. Automatic arresting brakes can, however, be released, to stop the train within a few yards, in case of any accidental release of the electric generator brake action. By this method, the energy of the descending train is not available for assisting in the driving of rising trains, but is expended locally in heating the locomotive resistor. There would, however, be little or no commercial advantage in utilizing the descending train energy for lifting the ascending train, because the traffic is very limited and the energy from the waterfalls would be wasted in any event. Moreover, the local expenditure of the energy of the descending train makes a more simple arrangement than a regenerative system, and simplicity of system is conducive to safety.

In the three-phase motor system, the usual method of operating during the descent is by allowing the three-phase motors on the locomotive to become three-phase generators, by their negative slip, or speed slightly in excess of synchronism. The machines thus act regeneratively, or restore energy to the line, and means must be provided in the system for absorbing this energy in order to permit the machines to exert brake action. A concrete case is offered by the mountain electric railway ascending the Gorner Grat, from Zermatt in the Swiss Alps. The railroad is a single-track, rack-and-pinion road, 5½ miles in length, with an average gradient of 18 per cent and a maximum of 20 per cent. The total lift is nearly 1 mile. Each electric locomotive has two 90-hp, three-phase motors taking current from two overhead trolley wires in the same horizontal plane, the track being the third conductor. The energy is generated at 5000 volts in the hydraulic power house near Zermatt, and is delivered to the trolley lines at 600 volts between lines, through step-down transformers stationed along the route. When only one train is being lifted, at five miles an hour, the turbines in the power house supply the lifting power plus the losses in the system. When this train has reached the summit, and commences to descend, it tends to act as a generator, and to help the turbine drive the generator in the power house. The attendant at the power house switchboard observes the turbine accelerate, and restores its normal speed by providing a triple water-rheostat load on the low-tension system at the station. This load absorbs the energy of the descending train, and keeps the turbine working under load as a prime mover. If, however, there is one train going up at the same time that another train is coming down, there is a partial utilization of the regenerated energy and the water-rheostat load may be reduced. In all normal cases, however, there is an expenditure of energy in the water rheostat when a train is descending, and the principal difference between the direct-current system and the alternating-current system in this respect, is that in the former the energy is wasted in a rheostat on the locomotive, while in the latter it is wasted in a rheostat at the station. In each case it does not pay to utilize all of the regenerated energy because a mountain stream pours steadily into the power-house reservoir day and night. If the water is not taken into the penstocks for driving the turbines, it flows over a bye-pass fall, for the enrichment of the scenery, but for no other useful purpose.

Visit of Germans to Schenectady.

A party of distinguished German visitors inspected the plant of the General Electric Company at Schenectady, N. Y., on Sept. 5, and were entertained by the officials. The visitors have been sent by the German government as a commission to visit America to inspect the electric railways and high-tension transmission systems of this country and Mexico. Numbered among the party are Privy Councillor Wittfeld, of the Prussian government; Prof. Dr. W. Reichel, of the Royal Technical University, Berlin; Director Frishmut, of the Siemens-Schukert Works; Mr. Pforr, of the Allgemeine Electricitaets Gesellschaft Railway Dept.; Director A. Elfes, of the A. E. G. Brunnenstr, and Director Jordan, of the Lahmeyer Works.

The party left Europe via Geneva, on the North German Lloyd liner "Moltke." The work of studying the power houses and locomotives of the New York Central lines, the Long Island Railroad, the New York, New Haven & Hartford system, and the plants of the Interborough Rapid Transit Company, was interspersed by entertainments given by the officials of the above mentioned plants, and by the officers of the General Electric Company. Boston interested the visitors with its big Lincoln Street power house of the elevated lines, the Curtis steam turbine equipment of the Edison Illuminating Company, and the equipment and service of the Boston traction system including the well-known East Boston tunnel under the Charles River.

Mr. C. B. Davis, general manager of the Boston office of the General Electric Company, entertained at luncheon at the Exchange Club. Those attending included General Bancroft, president of the Boston Elevated Company; Mr. Sullivan, president of the Massachusetts Street Railways, and Mr. C. L. Edgar, president of the Edison Illuminating Company.

The successful trip was continued to Albany, where the members of the commission put up at the Hotel Ten Eyck. They reached Schenectady on Sept. 5, and were shown through the various departments of the works and then entertained at the Mohawk Club. The reception committee consisted of Vice-President E. W. Rice, Jr.; Vice-President J. R. Lovejoy; General Manager G. E. Emmons; General Supt. E. B. Raymond; A. E. G. Representative Wm. S. Hulse; Asso. Mgr. Foreign Dept. M. A. Oudin; Engineer Railway Department W. B. Potter; Engineer P. & M. Department D. B. Rushmore; Engineer J. E. Noeggerath; Consulting Engineer Eugen Eichel.

All day the German flag floated over the works in honor of the occasion. The commissioners were surprised at the size of the works and the extent of the production in progress in the various shops. The huge shop No. 86, where the Curtis turbine generators are manufactured, impressed the visitors most, and they spent considerable time in the galleries watching the work in progress. They also found much of interest in the railway department, the wire and cable shops, the power house, and the foundries.

The Pay of British Telegraphers.

A report has just been made in England on the condition of the post office employees of Great Britain. It has been laid before the House of Commons, and the recommendations are likely to be adopted. A résumé of the report, forwarded by U. S. Consul-General R. J. Wynne, of London, is as follows:

"A careful analysis of the various recommendations of the committee leads to the conclusion that their acceptance will involve an ultimate annual cost to the nation approaching $2,500,000, although the increase per individual may appear small. A demand on the part of the organized carriers, clerks, telegraphers and telephonists for a 42-hour week has been rejected, while a weekly half-holiday is only recommended where the exigencies of the service permit. Free medical attendance or a small money grant given where the official doctors are not easy of access is to be allowed.

"The London telegraphists, who now rise to a maximum of $15.50 weekly, asked to go up to $24 weekly. The committee recommend that their maximum should be $16.25, with an excess allowance of 75 cents a week till promoted for passing a searching examination in technical telegraphy.

"The provincial postal and telegraph servants made large claims, in many cases asking that the maximum salary should be nearly doubled, but the increases actually recommended are not very great, though the lowest paid officers are recommended for considerable advances. The telegraphists and sorting clerks at these offices, the committee suggests, should be graded into five scales (instead of seven) with maximum salaries of $10, $11, $12, $13 and $14, respectively. A long list of alterations is suggested in the wages of other classes of postal servants. Women sorters, for instance, are recommended for a more rapid advance to the maximum of $7.50, and women telegraphists to a maximum of $10. An important change suggested is that women of all grades in the service should be no longer exempt from Sunday duty.

"Most of the changes recommended in wages are more in the nature of redistribution on the rate of progression than actual increases. The maximum has been raised to those employed in the Central Telegraph Office to $16.25 a week."

Investigation of New York Lighting Companies.

Although in the last three years the conditions of the various lighting companies of Greater New York have been thoroughly investigated, the Public Service Commission proposes to do practically all the work over again, as shown by its adoption, on Aug. 20, of the following resolution:

Resolved, That the following be adopted and that it be served upon the various gas and electric companies in this district:

You are hereby required to furnish within 30 days from the 23d of August, copies of the following documents relative to each and every company operated or controlled by you, whether by lease or sub-lease, by stock ownership or by joint agreement. These documents called for may be sworn copies or verified copies of the originals, and if filed in a public office that fact should be so indicated with the date of filing.

1. Certificate of incorporation.
2. Supplemental or amended certificates of incorporation.
3. Any act of the Legislature granting, confirming or limiting any right or franchise of the corporation, or affecting the right of the corporation to use or exercise any franchise.
4. Certificates relative to changes in the capital stock.
5. Any consolidation or merger agreement between companies now operating in connection with your plant.
6. Consents of local authorities constituting franchise rights.
7. Certificates from the state or municipal authorities, including departments, affecting your franchises.
8. Copies of all mortgages executed by you or by companies in your system.
9. Copies of all leases, deeds, contracts, or other documents in the chain of your title.
10. Location of all real estate owned in fee, described by metes and bounds.
11. Location of all real estate leased, described by metes and bounds.
12. Copy of any contracts executed between companies in your system or other companies as to the purchase or the sale of gas or electricity.
13. Reference to court decisions affecting the validity of your franchises.
14. As of July 1, 1907, the location of your plant or plants, and system, with a full description of your property and franchises, stating in detail how each franchise stated to be owned was acquired.
15. A map drawn to a scale of at least 2500 feet to the inch, showing all pipes, conduits, and other structures constructed or now maintained by you in the public streets.

The foregoing refers in each case to each company in your system except where otherwise noted.

Our New Home.

The accompanying illustration gives a view of the façade of the new building which last week became the future home of this journal. Situated about a half block west of Broadway, on Thirty-Ninth Street, the building is within a few blocks of the Times Square subway station and of the Sixth and Ninth Avenue elevated stations, and convenient to Broadway, cross-town and adjacent avenue surface lines. Its advantage of easy accessibility will be further increased upon the completion, several blocks south, of the Pennsylvania and McAdoo North River terminals and of the East River Belmont tunnel, which latter will land passengers at Times Square, three blocks north. A particular advantage of the location to the editorial staff is the neighborhood of the Engineering Societies Building, a block east, with its fine technical library at their service.

The over-crowded condition down-town is yearly becoming more aggravated, the streets even at the present time being crowded to an extent that interferes seriously with circulation. It appears to be only a short time when there will be an exodus up-town of certain lines of business, and the vicinity of Thirty-Fourth Street and Forty-Second Street, owing to ideal transportation facilities, promises to become a Mecca for this hegira. It was largely in view of this consideration that the present location was chosen for the future home of the several journals published from this office.

The building, which is known as "The Thirty-Ninth Street Building," has a frontage of 126 ft. on the north side of Thirty-Ninth Street with a depth of 98 ft., and consists of 11 floors and a basement. The front is flanked by pavilions which provide for the elevators, stairways and toilets, thus leaving unobstructed the main floors. There are recessed courts in the rear of the pavilions, the interior of the building thus being lighted from all sides. The building is entirely of reenforced concrete and probably the most advanced example of its type in the world. Prof. William H. Burr, of Columbia University, had charge of all the engineering details connected with the design and construction of the building, and it therefore goes without saying that the crudities are absent which characterized the earlier specimens of concrete construction. The steel re-enforcement of the columns is sufficient in itself to carry the load of the building. The floors, which are formed of re-enforced concrete slabs, are carried by re-enforced concrete girders of large size and wide span. These girders and their molded connection with the columns give to the ceilings a symmetrical and attractive appearance which recalls the beamed interiors of European medieval structures.

The external walls are finished entirely in concrete, the front façade having its surface carefully floated. To those who have had doubt as to the appearance of a large exterior entirely in concrete it will be an agreeable surprise to learn from this example that it is possible to produce an effect as handsome with a carefully worked concrete surface as with the use of the most attractive stone or brick.

In a future article the electric installation will be described in detail. For the present it will suffice to say that high-speed electric elevators are installed, there being two passenger elevators in the East pavilion, and one passenger and one freight elevator in the West pavilion. Current for all purposes—lighting and power—is taken from the street mains. The boiler equipment for heating is of such a character, and has sufficient capacity, to furnish steam for power should it become desirable at any time in the future to generate electric current on the premises. At the present, however, there does not seem to be any probability that an individual generating plant will have to be installed.

It is of interest to note that approximately 10,000 barrels of concrete and 1500 tons of steel were used in the construction of the building. Each of the floors of the building has an area of 10,500 ft. The offices of this journal are on the eleventh or top floor, where every modern office convenience has been provided. A large printing plant is now in course of installation in the building for the service of the several journals published by the McGraw Publishing Company and will occupy three entire floors, namely, the second, third and fourth floors. Several floors are, or will be, occupied by other publishers and by the American Institute of Social Service; the remaining space will be let for business purposes.

In the past third of a century, THE ELECTRICAL WORLD has never wandered far from the general post office in its change of quarters, and upon the completion of the Pennsylvania terminal will again be just a few blocks from its mailing point. From the time of its foundation in 1874 as THE OPERATOR, until 1886 THE ELECTRICAL WORLD occupied modest quarters in an old building at 9 Murray Street. In the last-mentioned year extensive quarters were secured in the Potter Building in Park Row, one of the first large New York office buildings. Growing demands for space led successively to removal three years later to the new Times Building on Park Row and to the Postal Telegraph Building in 1894. In 1898 the address again became 9 Murray Street, in a large building erected on the site of the former modest home. A year later, upon consolidation with the ELECTRICAL ENGINEER, the quarters of the latter journal at 120 Liberty Street were occupied, to be vacated in 1902 for larger space in a new building next door, 114 Liberty Street, the final down-town abode.

Recent Electrical Development in Europe.

Extensive plans are on foot in Germany and Switzerland for great electrical generating plants in connection with water powers, and also for applying electrical traction to railroads now operated by steam. The great success of the numerous great dams in Western Germany, like the Urft Valley Dam in the Eifel region, has created a strong movement for combining forces and erecting similar storage reservoirs on many of the rivers of the country. A society of German water-power owners was organized some time ago, and it is taking steps to form local branches wherever a number of owners having common interests in a water power can be got to pull together. Manufacturers of the most varied branches belong to these organizations; and in many regions they are the dominating element in the movement. This society began its operations in Western Germany, where most of the great reservoirs of Germany hitherto have been built. Special subsidiary societies have been organized for a number of the valleys of streams descending into the Rhenish-Westphalian industrial district from the highlands to the east. Some of the biggest reservoirs of Germany for the development of electrical energy have already been built in that part of the country, and still greater ones are planned. One of the latest and most promising is in the valley of the Möhne, which falls into the Ruhr at Neheim, with a dam 131 feet high and holding nearly 26 billion gallons, making it the largest reservoir on the Continent.

This society is working to extend its influence into other parts of the country. It is about to organize power-owners in the Nidda Valley in Hesse. The Nidda falls into the Main several miles below Frankfort, and the electrical energy generated from its waters would find a large market in the large industrial region of which that city is the center. Efforts are also making to organize in several of the Black Forest valleys. Organizations are also planned in Bavaria for the Lech, on which is situated the city of Augsburg, one of the leading cotton spinning and machinery centers of Germany; and for the Pegnitz, which would supply the numerous industrial establishments of Nuremberg and Förth with power. Later on it is intended to organize in the numerous valleys of other parts of Bavaria, as well as in the Thuringian Forest. One of the purposes of the society is to get all the water-power owners together so that they can throw their combined influence in favor of suitable legislation for carrying out great dam-building schemes.

Among the big dams about to be built in Central Germany may be mentioned one on the Eder in Waldeck, not very far from Cassel; while north of the same city the Diemel will be dammed at Helminghausen, near where that stream empties into the Weser. A meeting has been held in Karlsruhe in Baden to discuss the erection of two dams on branches of the Murg River, which emerges from the Black Forest at Rastatt. Here it is estimated that a maximum of 50,000 horse-power could be generated at an extremely low cost, and it could be easily carried to a number of manufacturing towns in the vicinity, or could be used for electrifying a part of the railways of the Duchy. Another and greater scheme in which that state is interested is a dam across the Rhine between Wyhlen on the Baden side and August on the Swiss side, several miles above Basle. The contracts have already been placed for building there, and work is to begin this year. The Bank für Elektrische Unternehmungen of Zurich, the stock of which is nearly all in the hands of the Allgemeine Electricitäts-Gesellschaft, of Berlin, is interested in the undertaking, which is to be one of the largest of the kind in Europe.

The city of Basle is taking action to build a dam on the Rhine to supply itself and its industries with electrical power. The idea was at first to build several miles below the city, but as this would have caused the water to rise into some of the lower streets it was finally decided to build above the city. The point at which the dam will be built is also mentioned as Augst, and it is not clear from the material at hand whether this is the same project as the one above mentioned. Another Rhine project of much promise is a dam still further north of Basle under the auspices of the Alsatian Government. It is to be built at the little town of Kembs. The energy to be generated here will be carried to Mihlhausen, some eight miles distant, where there will be a great demand for it in the numerous cotton and other mills of the place.

The problem of introducing electrical traction on standard gauge railways is receiving practical attention in Germany. This summer it has been stated that the Prussian railway authorities will electrify the railroad that runs from Cologne by Treves into the Saar Valley, using the numerous water powers of the Eifel region to generate electrical power. This would be an almost exclusively freight-hauling road, the purpose being to cheapen the cost of transportation between the great coal and iron region of the lower Rhine on the one hand and the Saar and Luxemburg-Lorraine industrial districts on the other. The last-named district produces vast quantities of low-grade iron ores, which will hardly stand the cost of transportation by steam railway to the iron furnaces on the lower Rhine; and it also has a great number of furnaces, the coke for which must be hauled from the Essen region. This electrical broad-gauge road is therefore designed to carry a very heavy traffic both ways; and it is expected that the cost of transportation will be materially reduced, as compared with the present steam locomotive system.

The kingdom of Bavaria has taken up the subject of electrical traction on ordinary railways, and it seems now quite within the possibilities that such a change will be made within a comparatively near-by period on all the roads in the southern part of the kingdom. A memorial has been prepared for presentation to the next Diet, or State Legislature, in which it is calculated that the introduction of electricity, generated by water-power, on the southern roads will result in a considerable saving of money in operating expenses. The total saving is reckoned at $1,660,000 a year, which means a saving of nearly $18 a year per horse-power used. It is estimated that the railways in question would call for about 200,000 horse-power, but the total amount of electrical power that could be obtained from the streams of the kingdom, as an official inquiry has shown, is about 700,000 horse-power. This would leave 500,000 horse-power available for industrial purposes. The plan of the Bavarian Government to change to electrical traction has been helped forward by the decision of the Austrian authorities to adopt electrical traction on the Arlberg Railway, which passes through the celebrated tunnel of the same name.

The idea of using electricity on standard-gauge roads continues to gain support in other parts of Germany. A suburban road at Altona and Hamburg was opened some months ago with electrical traction and is understood to be very successful. Another scheme that has been in the air for above a year is a road connecting Cologne and Düsseldorf. According to the last reports the experts of the two great manufacturing electrical companies at Berlin were working out the details of this scheme, under the sanction of the Prussian railway authorities; but it is not known what stage of progress has as yet been reached.

At Berlin several interesting electrical traction plans are being worked out. The Underground & Elevated Railway Company, which opened an electrical road through parts of Berlin and Charlottenburg about six years ago, is now engaged in extending an underground line through the central business section of the city, from the Potsdamer Platz to the Alexander Platz. At the same time the western end is being prolonged (underground) to the remote western side of Charlottenburg and will eventually be carried on to Spandau. Meanwhile the municipality of Berlin is slowly working out plans for building a subway on a north and south line through the Friedrich Strasse.

A still more ambitious plan, from the standpoint of cost and the amount of electricity to be required, is the proposed electrification of the so-called Stadtbahn, the great ring of steam road that encircles the city, with a connecting line through the heart of the business section from east to west. A conference was recently held under the auspices of the Minister of Railways, who ordered a memorandum on the subject to be pre-

pared and presented to him within a year. The Stadtbahn is now a double-track road; and a part of the electrification plans is to put in two more tracks above the present two, as a second story. Still another electrical project in Berlin is a so-called suspended railway, similar to the one that has been in operation at Elberfeld for some years. This road, for which ground was broken this week, will be built through the streets in the eastern part of the city, connecting some of the large suburban towns with the business and manufacturing quarters.

The success of electrical traction in the Simplon Tunnel has given a new impetus to the use of electricity on standard-gauge roads in Switzerland. It is reported that electricity will soon be introduced for hauling all trains from Domodossala, on the Italian side, up the mountain to Iselle, the southern entrance to the tunnel. It is said that the Swiss Government is considering proposals for turning over to several big electrical companies certain stretches of the state railways for the experimental introduction of electrical traction. The most tangible of these projects applies to the important line between Lucerne and Zurich, which the Oerlikon Machine Factory wants to electrify. Swiss electricians are confident that within the next two years a number of the railways of the republic will be operated entirely by electricity. The government has recently come forward with a plan to acquire the Gotthard Railway (connecting with Italy through the tunnel of that name); and it has already made an official investigation of the water-powers on both sides of the mountain, with a view to electrify the mountain sections of the road, at least, after it has been taken over by the state.

In Germany larger prospects for electricity are opening up through new inventions. Electrical methods for extracting atmospheric nitrogen for fertilizing and explosive purposes are attracting increasing attention; and it seems highly probable that large plants will be established for this purpose within a few years. A great company at Mannheim which manufactures aniline dyes has recently been negotiating for the acquisition of an immense water-power on the Alz River in Upper Bavaria, which will be used to generate electricity for producing nitrogen from the air. This month the organization of a company for producing nitrogen is reported from Gladbeck in Westphalia.

Still another field for the use of electricity seems to be opening up in connection with the vast peat marshes of Germany and other countries. Professor Frank, who discovered an electrical process for producing a nitrogenous salt ("kalkstickstoff") from the atmosphere, is co-operating with Siemens & Halske in working out an electrical process for partly drying the peat, which will then be converted into gas, to be burnt in gas-engines especially constructed for the purpose. It is hoped that a cheap method can be worked out which will render the immense peat resources of the country cheaply available. An experimental plant is being erected in Westphalia by the company named. Of course the new invention, if it succeeds, will be used in connection with electrical generating plants, distributing the energy to the places where it is needed.

New French Regulations as to Use of Electrical Power in Factories.

By decrees published last month, the French Government has modified the regulations of 1904, regarding the protective measures required in certain classes of work, or in various industries using electricity; new rules of a special nature having been substituted for those hitherto in force. The general intention of the authorities is that electrical installations should be protected in proportion to the maximum normal potential existing between the conductors and the earth; these installations being divided into the two following classes in accordance with such potential: First class: A. Direct current—Installations where the maximum normal potential between the conductors and the earth does not exceed 600 volts. B. Alternating current—Installations where the maximum effective potential between the conductors and the earth does not exceed 150 volts. Second class: Installations with potentials respectively higher than those above mentioned.

It is principally with installations of the second class that the new regulations deal. In such cases the stationary and conducting parts not traversed by the current must be electrically connected with the earth or must be electrically insulated from the ground. In the latter case, the machines are to be surrounded by a boarding which will not slip; also insulated from the ground and so arranged that it is impossible to touch at the same time the machine and any conducting body fixed to the ground. The grounding and electrical insulation must always be kept in good condition. The same rules apply to transformers depending upon installations of the second class, which must only be accessible to the staff in charge of them. When an electrical machine or apparatus is in a place serving at the same time for some other purpose, it must be fenced off or otherwise rendered inaccessible to those not in charge; a notice of the existing danger being posted up.

Uncovered electrical machines, incandescent lamps not doubly covered, and arc lamps or any other appliance producing sparks are prohibited in workshops containing explosive substances, or in those where detonating gas or any inflammable dust may be produced, unless they are provided with a covering insulating them from the atmosphere. The ventilation of places intended for accumulators must be sufficient to insure the escape of gases liberated.

Switchboard distributing currents of the first class must be insulated and arranged so as to prevent all danger. The regulations as to machines of the second class likewise apply to switchboards bearing appliances and metal parts coming under that category.

Other detailed regulations deal with the spaces surrounding electrical machinery and appliances and the installation of conduits. Among the points upon which stress is laid is that the touching of machines of the second class (even with rubber gloves) or working on such machines (even using tools with insulating handles) should be strictly prohibited. Machines of this higher voltage must in future bear distinct marks or signs to that effect in paint or otherwise.

Exposed conductors or other electrical appliances are not to be allowed within reach of the workmen's hands in places where the floor or the walls are of a very conductive nature, by reason of saline deposits resulting from the work carried on or of damp.

CURRENT NEWS AND NOTES.

WIRELESS TELEPHONY.—The Navy Department, it is stated, will equip with wireless telephone apparatus all the battleships going to the Pacific, the apparatus being guaranteed to have a speaking range of five miles in all weathers.

OLD TIME TELEGRAPHERS.—Owing unfortunately to the present unsettled condition of affairs in the telegraphic field, it has been decided to postpone until a date to be fixed hereafter the annual reunions of the Old Time Telegraphers and the U. S. Military Telegraph Corps, fixed originally for Sept. 16, 17 and 18 at Niagara Falls.

EMPIRE STATE GAS AND ELECTRIC ASSOCIATION.—The annual meeting of the Empire State Gas & Electric Association will be held in the Concert Hall, Madison Square Garden, on Oct. 2. The full programme will be announced later. On the evening of Oct. 1, the night before the regular meeting, there will be a joint meeting under the auspices of the Street Railway Association of the State of New York and of the Gas & Electric Association in the Concert Hall. There will be several addresses followed by an informal reception when an opportunity will be afforded to the Commissioners of the first and second districts, whom it is hoped will be present, to meet the representatives of the companies.

TELEPHONE BRIBERY.—At San Francisco on Aug. 31 the jury in the case, after one ballot, found Mr. Louis Glass, vice-president of the Pacific States Telephone & Telegraph Company, guilty of bribing a supervisor in connection with a telephone franchise. It will be remembered that, according to the allegations, the board of supervisors "held up" both the old Bell Company and a new independent company for large sums in connection with their franchises.

RACE NEWS BY WIRELESS.—The New York police raided, on Sept. 2, a full-fledged wireless telegraph plant in the top story of the house of a vaudeville comedian at Sheepshead Bay, just outside the famous racetrack. Since the wires of the telegraph companies were cut out, many attempts have been made to secure news promptly after a race for the poolrooms, but this seems to be the most ingenious effort detected. The apparatus of a well-known wireless telegraph company was found on the premises.

NEW TELEGRAPH COMPANY.—A special dispatch from Chicago of Sept. 8 says: "L. K. Davis, who has an office in the First National Bank Building here, has announced the projected organization of the New American Union Telegraph Company, with $5,000,000 capital. Mr. Davis says that the new company will be ready to begin operations by Jan. 1. The plan, as he describes it, is to lease telephone wires, and use them as telegraph lines. J. P. Hornaday, of New York, is said to be connected with the enterprise."

ABBREVIATING COURTESY.—"Marcus Aurelius," remarks the New York *Tribune,* "held that no man should ever be so busy as to have no leisure. Yet here is the telephone company in Philadelphia requesting that in order to save time subscribers will not say 'please' to operators in calling for numbers, and decreeing that operators shall never use that unnecessary word. There are some places in which such sacrifice of courtesy to curtness would not be surprising. But we did not expect it in the City of Dignified Deliberation."

FIRES IN NEW YORK.—A very interesting chart has recently been completed covering 6357 fires in Manhattan and the Bronx. It is estimated that fires started by carelessly dropped matches and cigarettes cause New York City a loss of about $2,500,000 each year. The city has an average of 23 fires every day, and fire losses in 12 months from all causes aggregate something like $10,000,000. Every time an alarm comes in, whether it is false or not, the cost to the city is $50 for wear and tear of the fire apparatus. Of the 6357 fires charted in Manhattan and the Bronx for the year, 989 of them happened on Tuesdays. Tuesday is ironing day. The chart shows that the busiest hour of the city fire department is between 6 and 7 o'clock in the evening. This is accounted for by the fact that factories and offices have just been closed and stray origins of blazes accidentally left around have time in the hour to flare up and do their work. It is shown that the hours between 6 and 12 o'clock at night are most fruitful of fires.

VERMONT ELECTRICAL ASSOCIATION.—The sixth annual meeting of the Vermont Electrical Association will be held at St. Albans, Vt., Sept. 18 and 19. The first day will be devoted to an outing with games and a shore clambake. On the morning of the second day a visit will be made to the plant of the Vermont Power & Manufacturing Company, at Fairfax Falls, the power house of which is built into solid rock on a bank of the Lamoille River, and supplied with water through a 40-ft. tunnel. A special feature of the meeting will be a discussion on steam heating to be opened by Mr. William J. Cohoon, of Portland. In addition papers will be presented as follows: "Sale of Current for Charging Automobiles," by Mr. Frank J. Stone, of Boston; "Talk on Modern Illumination," by Mr. V. R. Lansingh, of New York; "Notes of a Layman on Electricity and Its Allied Forces," by Mr. E. L. Bates, of Bennington; "Co-operative Commercialism in the Electrical Field," by Mr. J. Robert Crouse, of Cleveland; "Rates and Systems of Charging," by Mr. J. D. Codman, of Boston.

GLASS TELEGRAPH POLES.—U. S. Consular Agent Gustav C. Kothe, of Cassel, an agency of the Frankfort consulate, states that an architect of that city has been granted patents in Germany and other European countries and also in the United States for an invention for the manufacturing of glass telegraph and telephone poles. Mr. Kothe writes: "A stock company has been organized and a factory for the manufacturing of glass poles has been built at Grossalmerode, a town near this city. The glass mass of which the poles are made is strengthened by interlacing and intertwining with strong wire threads. One of the principal advantages of these poles would be their use in tropical countries, where wooden poles are soon destroyed by the ravages of insects and where climatical influences are ruinous to wood. The selling price of the poles has not been fixed yet, but the company is willing to accept 25 marks ($6) for a pole of the length of 7 meters (about 23 feet). The Imperial Post Department, which has control of the telegraph and telephone lines in this country, has ordered the use of these glass poles on one of its circuits."

OAKLAND, CAL., LINES ELECTRIFIED.—Contracts for the electrical equipment of the suburban lines in Oakland, Cal., and vicinity belonging to the Southern Pacific Railroad Company, were let last week at the New York office of the company. The service given is distinctly of a suburban rapid transit character, as the lines serve to connect San Francisco with the large residential communities of Oakland, Berkeley and other important places lying opposite San Francisco, across the bay. The commuter traffic is confined largely within a radius of about seven miles, and the different roads conducting this service converge at Alameda Mole, where they connect with a line of ferry boats which carry the passengers across the bay to San Francisco. The stations on the suburban lines are located on an average of .4 of a mile apart and the system as a whole is said to do a larger suburban business in number of passengers carried than any other in the country, the Illinois Central suburban lines out of Chicago alone excepted. The electrical equipment now decided upon will consist of multiple-unit trains with from three to twelve cars per train, made up in the usual combination of motor and trail cars. The cars seat 80 passengers each. Eighty motor cars have been ordered, which will be equipped each with four 125-hp motors. The power stations will contain two 5000-kw, 25-cycle, 13,200-volt, three-phase generators.

TESTING METERS.—This week the special committee of the Empire State Gas & Electric Association on testing meters, to represent it with the Public Service Commission of the second district of New York State, meets at Albany for the purpose of organization, electing a chairman and outlining the course of work and investigation. The committee are: T. R. Beal, Poughkeepsie Light, Heat & Power Company; H. J. Blakeskee, Bureau of Gas and Electricity, city of Syracuse; G. W. Cunningham, Elmira Water, Light & Railway Company; C. R. Huntley, Buffalo General Electric Company; L. E. Imley, Niagara Falls Power Company; J. C. Langdell, Hudson River Power Company; F. B. H. Paine, Niagara, Lockport & Ontario Power Company; Prof. Robb, Troy Gas Company; R. M. Searle, Rochester Railway & Light Company; J. M. Sheehan, Upper Hudson Electric Company; Silas Tabor, Moravia Electric Company; Arthur Williams, Yonkers Electric Light & Power Company. At the meeting on Aug. 28, of which note has already been made, it was moved by Mr. L. W. Emerick that it was the sentiment of the meeting that the sealing of electric meters was impracticable. The motion was carried. It was later moved by Mr. Hutchins that it was the sentiment of the meeting that the testing of electric meters by the commission on complaint of the customer was welcomed by the companies present at the meeting. The motion was carried. Mr. C. H. B. Chapin is the secretary of the association, which is necessarily deeply interested in this subject.

The Kaministiquia River Water Power Developments.

Before beginning the construction of its hydroelectric plant, the Kaministiquia Power Company made a careful investigation of the variations of the flow of the Kaministiquia River and of other features which would affect the reliability of the service obtainable from it. A general plan was then adopted for the development of the power at Kakabeka Falls on the Kaministiquia River with an initial installation of 14,000 horse-power; plans being made and the greater portion of the work carried out on the basis of continuing the initial installation to an ultimate development of 40,000 horse-power.

The design consists of diverting the water from Kaministiquia River just above Jacques Cartier Rapids, about one-half mile above Kakabeka Falls, and carrying the water by means of concrete flumes 10 ft. 2 ins. in diameter, a distance of 6500 ft. to a reservoir located on a high plateau, and thence discharging by means of steel pipes to the wheels in the power house under a head of 180 ft., the water wheels so driven being direct-connected to the alternators and the electricity so produced transmitted at a potential of 25,000 volts 18 miles to Fort William, Ont.

All water rights and the necessary land abutting on the river from the point of diversion to a point of return were secured, as well as all land necessary for flumes and other structures.

The actual work of development was commenced in 1905. To facilitate construction, a siding and temporary station were built on the line of the Canadian Northern Railway about one-half mile from the falls. A narrow-gauge railway was constructed for delivering the supplies to the headworks and power house and for distributing the material along the pipe line. The first alternator of 7000 horse-power capacity was put into commercial operation delivering power to Fort William in December, 1906.

SOURCE OF SUPPLY.

The Kaministiquia River has its source in Dog Lake, situated about 50 miles north of Kakabeka Falls. There are a number of rivers emptying into the Kaministiquia; the principal source, however, is Dog Lake, which covers an area of 51½ sq. miles.

The lake is surrounded by heavy timberland and a large amount of muskeg or bog. The timber retains the snow until well into the summer months, and the muskeg retains the water until the lake falls sufficiently to draw on this source of supply.

The power company has the right to raise the water level of the lake 10 ft. and lower it 3 ft., thereby allowing a storage of 13 ft., which, if required, would give a storage capacity that would take care of the dry season, and if necessary give a constant supply equal to 60,000 horse-power.

UTILIZATION OF ELECTRICITY.

The electricity is used for all branches of service, lamps, motors and for railway purposes in the town of Fort William, and the power company is now negotiating to supply electricity in Port Arthur.

FIG. I.—VIEW OF INTERIOR OF POWER HOUSE.

The electricity is distributed as alternating current, three-phase, and is delivered to the corporation of the town of Fort William, who redistribute it to the small consumers. The power company supplies all customers requiring more than five horse-power.

Before the power plant was completed, contracts had been signed for electrical power as follows:

Canadian Pacific Railway Company	2200	horse-power
Ogilvie Flour Mills Company	1500	" "
The town of Fort William	600	" "
The Canadian Iron & Foundry Company	350	" "
The Consolidated Elevator Company	250	" "
Muirhead & Black	50	" "

The electricity is distributed from a sub-station built in the center of the town of Fort William, Ont.

DAM AND INTAKE.

At a point one-half mile above Kakabeka Falls, on the Kam-

inistiquia River, is located the dam and intake of the Kaministiquia Power Company. Here the water necessary for the operation of its plant is diverted by solidly constructed dams through a concrete intake to flumes, which are constructed on the south side of the river and extend to the forebay a distance of 6500 ft. The main dam is about 300 ft. long and averages 15 ft. high. It is built of concrete on the bed of the river, which is solid rock. The dam is constructed of concrete piers 4 ft. wide by

FIG. 2.—HEAD WORKS.

25 ft. long. These piers carry a bridge and the mechanism for raising and lowering stop logs set in channels in the piers.

The intake is set at almost right angles to the dam and is so constructed that ice and débris cannot readily enter it. The entrance canal is about 125 ft. long; at the end is located a spillway for discharging any ice or débris that may possibly pass the first set of racks. Adjoining the spillway are the small racks protecting the entrance to the concrete flumes.

FLUME.

From the headworks to the reservoir the water is carried in a concrete pipe, which is 10 ft. 2 ins. inside diameter. This flume is built partly on top of the ground and partly below. The pipe is not level, but in a measure follows the profile of the ground. The maximum pressure on the pipe is, at full head, about 12 lbs.

As soon as the concrete pipe was constructed and time allowed for the concrete to set, the pipe was covered to a depth of 2 ft. Drain valves, air vents, etc., are provided at various points along the pipe line and provision is made for lighting and heating the vents, drains, etc., in an emergency and in cold weather.

FOREBAY.

The concrete pipe just described discharges its water into a

FIG. 3.—MAIN DAM CLOSED.

forebay located on a high plateau about 165 ft. above the power house floor. This forebay serves as a relay to maintain the plant in continuous operation, to take care of fluctuating demands of the water supply, and is also used to take care of the excess water that would accumulate in the event of a sudden shut-down in the power house. The forebay is a massive structure built of concrete and covered in to protect employees and mechanism from the weather.

Each of the two riveted-steel penstocks is 750 ft. in length, 7 ft. in diameter and ¼ in. thick at the upper end and tapering to 9/16 in. at the power house. These pipes were constructed by the Jenckes Machine Company, of Sherbrooke, P. Q. The penstocks are anchored by massive concrete abutments, and are housed in the entire distance between the power house and the forebay.

POWER HOUSE.

The power house is a massive concrete and steel structure built on the bank of the river on a foundation of rock. The

FIG. 4.—CONCRETE PIPE LINE.

building is completed for the entire development with the exception of an extension of 100 ft. for the additional generators. The transformer and switching arrangement, switchboards and everything necessary to operate the ultimate capacity of the development is complete and the extension will consist of merely the two walls and roof to allow space for the additional units.

The steps, walls, partitions and everything about the electrical apparatus and power house are built of either concrete or steel. The windows are of fireproof construction, the frames and sashes being made of galvanized iron and glazed with wired glass.

Each unit consists of two horizontal turbines mounted on one shaft and direct connected to the alternator. The turbines have a maximum capacity of 7000 horse-power, and were fur-

FIG. 5.—KAKABEKA FALLS.

nished by J. M. Voith, of Heidenheim, Germany. They are controlled by automatic governors operated by means of oil under pressure and driven from the main turbine shaft. The governors are also of the Voith make.

There are two revolving-field alternators, made by the Canadian General Electric Company, of 4000 kilowatts capacity each and having an overload capacity of 25 per cent. They are

wound for three-phase, 4000 volts and a frequency of 60 cycles per second.

Two 150-kw, 125-volt, 600 r. p. m. compound wound exciters are provided, each direct-connected to a Voith water wheel. The wheels driving the exciters are equipped with automatic governors, and the water can be supplied to the exciter water wheels from either penstock. Each exciter is capable of supplying five generators under all conditions.

FIG. 6.—PENSTOCKS FROM ICE BAY.

There are two banks of transformers installed in the power house, each bank consisting of three 1500 kw, air-cooled transformers with 25 per cent overload capacity. Each bank has a capacity equivalent to one generator. The transformers are star-connected and the system operates with grounded neutral; the maximum pressure on the line to ground being 15,000 volts. The transmission potential, however, is 25,000 volts.

For connecting each generator and transformer bank to the low-tension bus-bars and each transformer bank and transmission line to the high-tension bus-bars a full complement of remote-control, motor-operated switches is provided.

Disconnecting switches are provided throughout the plant so that any part or any piece of apparatus can be disconnected from the system by knife switches in addition to the oil-circuit breakers. Any bank of transformers may be transferred to any line or to any one of the generators. The system is provided

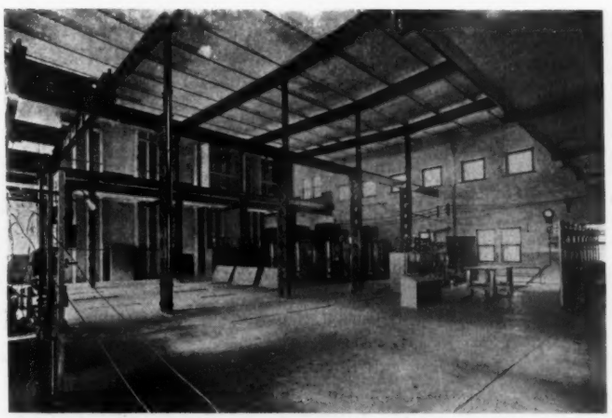


FIG. 7.—VIEW OF INTERIOR OF FORT WILLIAM SUB-STATION.

with time limit relay switches, so that in the event of trouble the system will be automatically disconnected. The apparatus at both ends of the system is protected by means of horn arresters, also by means of choke coils and the carbon resistances and spark-gap arrester.

TRANSMISSION LINE.

From the power house two parallel lines run a distance of 20 miles to Fort William. The transmission line is operated at a pressure of 25,000 volts. Cedar poles are used, and the cross-arms are of Southern or yellow pine. Stranded copper conductor is used throughout for the transmission line. Where the line passes through a wooded section, all dangerous timber has been cleared well back on the line adjacent to the right of way on both sides, so as to protect the transmission lines.

No. 4 steel wire is carried on each end of the top cross-arm. This wire is grounded at every third pole by means of a copper conductor soldered to a copper plate 1 ft. sq. and buried under the pole. The transmission poles carry a telephone line supported on cross-arms 5 ft. below the main arm. The telephone line consists of No. 9 steel wire transposed every third pole and is carried on double petticoat glass insulators supported on locust pins. The telephone line operates satisfactorily.

SUB-STATION.

The receiving station in Fort William is built near the western city limits. Here the e. m. f. is reduced from 25,000 volts to 2300 volts for local distribution throughout the town of Fort William. Control is provided by means of motor operated oil switches for the incoming high-tension lines and for the banks of transformers. This station contains a large marble switchboard for controlling the local lines. This switchboard is so constructed that two sets of bus-bars are employed for local lines. The switchboard is sub-divided so that each panel has a capacity of 1000 kilowatts at 80 per cent power factor. Each panel contains a watt-hour meter and indicating wattmeter, three ammeters, curve drawing wattmeters and double-throw oil switches, so that any circuit may be connected to any bus-bar. The bus-bars, switchboard and everything connected with the distributing switchboard is concrete, steel or marble.

While the plant has been in operation only a short while, the company has already secured a load of 5000 horse-power, all of which is sold at the flat rate price of $25 per horse-power for 24-hour service per year. This price is remarkably low for that section of the country. The chief engineer of the company is Mr. R. S. Kelsch, of Montreal. Mr. W. L. Bird is superintendent of the plant.

Fort William is growing very rapidly, being situated at the head of the Great Lakes and a very large number of industries is located in Fort William in order to secure reliable electric energy at reasonable rates, to avoid the long freight haul from distant cities, and because it is possible to secure raw material of every description from Canada and the United States by means of lake freight. Immense elevators are located in Fort William for handling the wheat annually shipped to it. The new Grand Trunk Pacific Railway Company has its main terminus at Fort William, where additional elevators with a capacity of from 10,000,000 to 12,000,000 bushels of wheat will be located. Among the proposed new developments for Fort William is a ship dock, wire and rolling mill, a pipe and car rail foundry, and a car works, etc., etc.

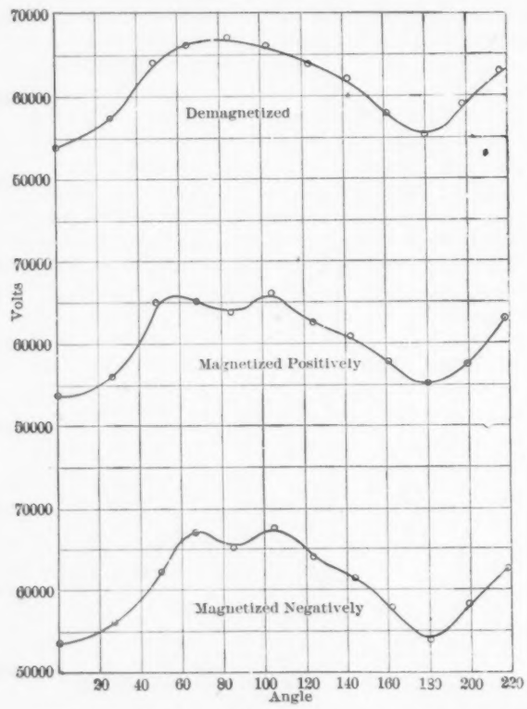
Abnormal Primary Current and Second Voltage on Placing a Transformer in Circuit.

BY TRYGVE JENSEN.

In elementary treatments of the phenomena of stationary alternating-current transformers it is customary to consider that the secondary e. m. f. on open circuit bears to the primary e. m. f. the ratio of the number of turns in the respective coils, and that the primary current has a small percentage of its full-load value. It is well known that the above-mentioned relations do exist after the primary circuit has been connected to the supply lines for a sufficient length of time for the internal reactions to reach their final cycle of changes, but that the conditions at the instant of closing the primary circuit are far from being so well defined as given in the above outline. The present article records the results of experimental observations of the values of the primary current and the secondary e. m. f. when the primary circuit of a transformer is closed at different predetermined time-phase positions of the supply e. m. f. The tests were conducted by Mr. J. W. Andree and the writer in the electrical engineering laboratories of the University of Illinois.

A special slip-ring contact device that could be moved along the shaft of the supply generator in order to close the primary circuit, when desired, and the brushes upon which could be turned circumferentially around the shaft, allowed the exact time when the primary circuit would be closed to be definitely determined in electrical degrees. Both the primary current and the secondary e. m. f. were observed by two different methods, which for convenience can be designated as the "recording" method and the "trial maximum" method. In the former method an oscillograph was used for recording the relative values of the normal e. m. f. and currents and the instantaneous values reached during the starting period. In the latter method the instantaneous maximum value of the e. m. f. was found by trial by adjusting a spark-gap in the high-potential secondary circuit until an arc was formed across the gap when the circuit was first closed; the value of the e. m. f. was ascertained from the known relation between the e. m. f. and the sparking distance between needle points in air. The instantaneous maximum value of the current was found by trial by connecting an electromagnet of great sensitiveness in parallel with an adjustable resistance which was inserted in the primary circuit. The electromagnet was a telephone-switchboard drop-signal, and the arrangements were so made and calibrations so conducted that the maximum instantaneous value of the current through the primary when the signal dropped was definitely known for each adjustment.

The transformer with which the tests were made was a 10-kw, 440-to-100,000 volt, 60-cycle transformer; the tests were so conducted as to afford a maximum secondary e. m. f. of only 50,000 volts under continuons operation. Thus the core was far



FIGS. 1, 2 AND 3.—SECONDARY E. M. F., WITH AND WITHOUT INITIAL MAGNETIZATION.

from being magnetically saturated during operation. The e. m. f. wave of the alternator was approximately sinusoidal, with a slight amount of flattening at the crests.

Three series of observations by the "trial maximum" method were made of the secondary e. m. f. on closing the primary circuit. In one of these series the core of the transformer was thoroughly demagnetized before closing the primary circuit; in the second series the core was magnetized (positively) by means of 25 amperes of direct current before each observation; in the third series the core was (negatively) magnetized by means of 25 amperes of direct current. The excessive value of the residual magnetism for the latter two series will be appreciated when it is known that the normal exciting current of the transformer is only 1.5 amperes. The results of these series of tests are indicated in Figs. 1, 2 and 3, where 90° corresponds to the closing of the primary switch when the primary e. m. f. was at its maximum. It will be observed that in each case the secondary e. m. f. reached its maximum value when the primary switch was closed at the maximum point of the primary e. m. f.. The maximum secondary e. m. f. reached values as high as 67,000 volts and never fell below 54,000 volts, although the normal operating secondary maximum e. m. f. was only 50,000 volts. Thus it is evident that it is impossible to close the primary switch of a transformer directly without producing a secondary voltage in excess of the normal. A comparison of Figs. 1, 2 and 3 will show that the three curves are very similar, and that the numerical values are substantially the same regardless of previous magnetization. One is led to conclude that notwithstanding its excessive value, residual magnetism has practically no effect upon the value of the secondary voltage rise.

Two series of observations were made of the maximum instantaneous value of the primary current upon closing the primary circuit at different points on the e. m. f. wave of the generator. One of the series was made under what would be considered normal conditions, by closing the primary circuit directly, while in the other a coreless inductance having a coefficient of self induction of .01 (a reactance of only 3.77 ohms at the normal frequency of 60 cycles) was inserted in series in the primary circuit. The results of these tests are shown in Fig. 4. It will be noted that although the normal primary exciting current is only 1.5 amperes the current on closing the circuit rises as high as 17 amperes without series induc-

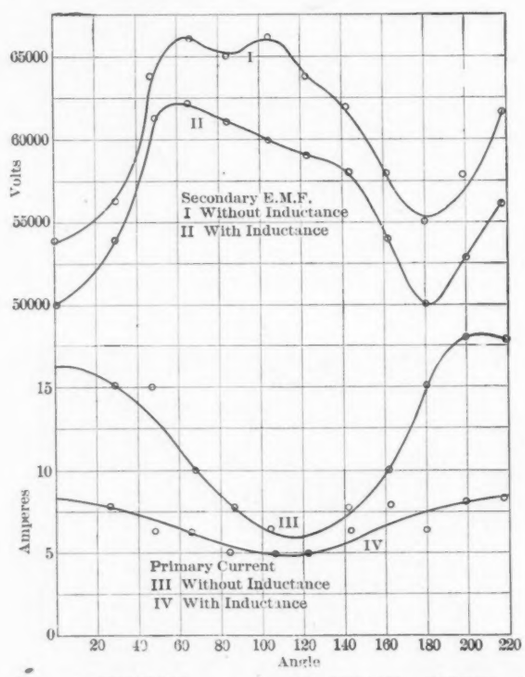


FIG. 4.—SECONDARY E. M. F. AND PRIMARY CURRENT, WITH AND WITHOUT SERIES INDUCTANCE.

tance and even at the best point of closing the circuit it reaches 5 amperes. The rush of current is largest on closing the primary circuit at the zero point of the e. m. f. wave and least on closing it at the maximum. That is to say, when the circuit is closed at the maximum point of the supply e. m. f. wave the rate of change of flux is largest (as seen from the secondary e. m. f. curves in Fig. 4) but the rush of primary current is least; if the switch is closed at the zero point of the supply e. m. f. the primary current rises to higher values but the rate of change of flux is less, and the secondary e. m. f. is smaller. Fig. 4 shows at a glance the beneficial effect of using a coreless inductance in series with the primary. Thus there

was a marked reduction in both the primary current and the secondary e. m. f.; the maximum secondary e. m. f. was reduced by about 7 per cent, while the rush of primary current was reduced by about 50 per cent.

In explanation of the causes for the rush of primary current the following considerations may be noted. Suppose in the first case that the transformer core is magnetized (due to residual magnetism) in the same direction as that in which the current will tend to flow on closing the circuit. The counter e. m. f. at the first instant will be negligible because a large value of current is required for increasing the flux already in the core. The current will reach the value required to produce a rate of change in the flux such that the counter e. m. f. due thereto is practically equal to the impressed. When the iron is initially nearly saturated there will be required an enormous rush of current to produce the necessary rate of change in the flux. As the current decreases to zero a large value of residual magnetism will be in the iron, and a small value of current in the opposite direction will produce a large change in the flux, and the resultant counter e. m. f. will immediately limit the value of the current. This small reverse current will decrease the residual magnetism (but will not remove its effects entirely) and the phenomena of the first cycle will repeat itself—in a less degree; the current peaks will gradually decrease until finally the normal value is reached.

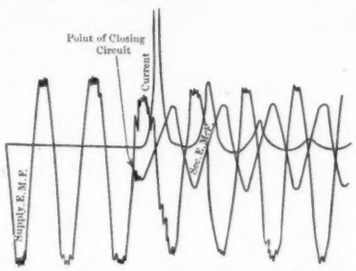


FIG. 5.—CONDITIONS ON CLOSING THE PRIMARY SWITCH AT ZERO POINT OF E. M. F. WAVE.

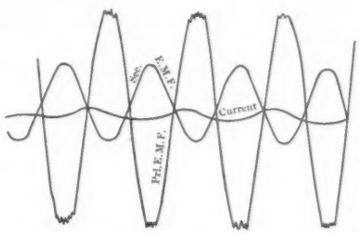


FIG. 7. — NORMAL OPERATING CONDITIONS.

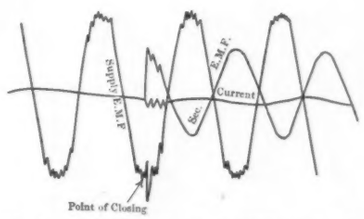


FIG. 8.—CONDITIONS ON CLOSING THE PRIMARY SWITCH ON MAXIMUM POINT OF E. M. F. WAVE.

Consider now the case in which the initial residual magnetism is opposite in direction to that which the initial current would tend to produce. The current during the first half cycle will be much less than normal, while that during the second half will be peaked.

From the above it will be seen that peaks will occur during only one-half of each cycle. The phenomena will be more pronounced on closing the circuit on the zero point or the rising part of the supply e. m. f. wave with the magnetism in the same direction, than on the decreasing part of the wave; in the latter case the residual magnetism will be decreased before the current will tend to flow in a direction to increase the magnetism.

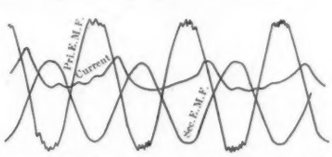


FIG. 6.—CONDITIONS SHORTLY AFTER CLOSING THE PRIMARY SWITCH.

The foregoing conclusions were fully confirmed by the oscillograms, as shown in Figs. 5, 6, 7 and 8. In order to obtain these records use was made of an oscillograph having three galvanometers. A test coil was wound on the transformer core to serve as a secondary for indicating the secondary e. m. f. Records were made of the supply e. m. f., the secondary e. m. f. and the primary current. The curves are self explanatory, since they record automatically the point on the supply e. m. f. wave at which the circuit was closed, and show all of the variation taking place in the three curves represented. Thus Fig. 5 represents the condition on closing the primary switch on the zero point of the e. m. f. wave, and shows an enormous rush of primary current; in this case the transformer probably possessed a considerable amount of residual magnetism. The conditions shortly after closing the switch are shown in Fig. 6, while Fig. 7 indicates the normal operating conditions. Fig. 8 represents the condition on closing the primary switch when the supply e. m. f. was maximum; there was no appreciable rush of primary current, but a violent vibration was noted in the primary (supply) e. m. f.

The oscillogram shows conclusively that when the primary switch is closed the secondary e. m. f. rises at once to its full value and even above. Thus the old theory that the rush of primary current is due to the iron core not becoming magnetized is incorrect. Moreover, the excess secondary voltage is not caused by the rush of primary current; the abnormal current occurs after the excess voltage has disappeared (see Fig. 5). It will be noted that on closing the primary circuit vibrations took place in both the supply (primary) e. m. f. and the current; the number of zigzags was always three. In some instances the primary e. m. f. increased by 25 per cent above normal. Such increase is possible only when a current passes through the generator armature in a direction to raise its e. m. f. The vibrations observed corresponded in frequency to the number of slots on the armature. It seems probable that the armature conductors carrying heavy currents on suddenly leaving the alternator field produced vibrations in the e. m. f. and in the primary current and that the vibrations in the current reacted on the generator field. That the rush of current takes place in only one direction is shown conclusively by the oscillograms. They also verify the results of the experiments by the "trial maximum" method in showing that the rush of current is largest on closing the circuit at the zero point of the supply e. m. f. wave.

Electrical Development in Argentina.

By Lewis R. Freeman.

SHORTLY before I left Buenos Ayres a few months ago, the United States consul sent for me, said that he had recently had inquiry from the States in regard to power development possibilities in Western Argentina, and asked me to look into the matter during my journey through that section and to send to him a report of the results. The facts briefly recorded below were elicited from talks with several of the most prominent residents of Mendoza, and, as far as they go, are of perfect authenticity.

I would first state that there are few places in the world where the development of electrical power, or the discovery of oil in quantity, would meet with so great a reward as in Argentina, and in the western part of that country in particular. With an almost unlimited demand for power, that country produces not a ton of coal, not a barrel of oil, and only a small quantity of hardwood that is generally too valuable in dye stuffs or tannic acid to allow of its being burned for steam. All the railroads and factories use coal that is brought from Newport or Cardiff under a heavy ocean freight, to which, for use in Western Argentina, must be added the cost of 700 miles of haulage by rail. Naturally nothing would be more welcome to that part of the country than the development of power that would permit it to dispense with this high-priced fuel.

I heard it suggested that the railroads, being the parties most

interested, should be the ones to take the lead in these projects. It is true that the railroads would ultimately be the greatest beneficiaries, but there would appear to be two reasons why their hands are tied; the first of these is that they are young, and full of business, and have need for all of their available capital in the extension of their lines; the second reason is that they are entirely under the thumbs of their London directorates. A London directorate is the bête noire of a progressive Argentine railway manager. It is usually composed of men who know little about railroading, and whose only lookout is to see that their capital yields them the 4 per cent—no more and no less—that they have been taught from childhood is the correct thing to receive from large investments. They are men of the stamp of those of that good old London banking house that will not consider for a moment the use of telephones, typewriters, steel pens or even printed letter heads; men of the stamp of that Chinese mandarin who refused to allow electric light in his province because Confucius had used oil. They are safe, solid and honest to the last degree, but completely fossilized. Thus with the English unwilling, and the Argentinos incompetent, there would appear to be an unusually favorable opportunity for some enterprising North Americans to slip in and make a substantial clean-up.

First a few words in regard to an oil proposition, which, in the right hands, might yield returns quite as handsome as those from the development of electrical power. For many years the existence of heavy oil seepages in the foothills of the Andes at a distance of 33 kilometers—about 20 miles—from Mendoza was known to the people of that city, and for some time the asphalt, where the oil had solidified, had been brought into town and used on a small scale for paving and sidewalks. About 12 years ago it occurred to some of the native Argentinos that possibly this oil could be collected and made of value. A company was formed—composed entirely of Argentine citizens—leases and concessions for the land were obtained from the government and some crude boring rigs purchased and set to work. At the comparatively small depth of 150 feet oil was struck, which, until capped, spouted 20 feet above the ground. Several other wells met with like results.

The difficulty then was to find some one to use the oil. This was not as easy as would appear, and over a year went by before the local gas company could be induced to purchase some of it to use in the manufacture of illuminating gas. For this purpose it was brought to Mendoza in tank carts, the results obtained being most favorable. Another year went by before the manager of the "Great Western" railway would consent to build and experiment with an oil-burning locomotive. When tried, however, the experiments were so uniformly successful that, under pressure, the London directorate was finally brought to permit the closing of a long-time contract for the supplying of the company with oil for its engines. Thus encouraged, the oil company built a pipe-line from its wells to Mendoza, the elevation of its source being sufficient to make the oil descend by gravity. A large tank—which still stands—was built to receive the oil, and everything was ready for its delivery, when a slight shock of earthquake occurred and the wells stopped flowing. A few half-hearted and badly directed efforts were made by the company to stir them into life again, but without success. At this juncture the London directorate of the railroad, glad of a chance to be rid of the "new-fangled contraptions" that were being forced upon it, brought about the annulment of the contract. This disheartened the easily discouraged Argentinos, and they gave up in despair. That was nine years ago and nothing has been done with the wells since.

A Mendoza engineer—a man without any technical knowledge of oil wells, but a good deal of common sense—told me that in his opinion the earthquake shock has either bent or twisted the casings, or else had caused a cave-in at the oil level and cut off their connection with the oil. In either event, the driving of new casings, which the timid Argentinos behind the company had not had the courage to do, would have remedied the difficulty.

I also learned that there was a considerable oil seepage, of the same nature as the one of which I have just written, on the "Great Western" railway, about two-thirds of the distance from Buenos Ayres to Mendoza. At this latter point no concessions have been granted and no development done.

The facts in regard to the possibility of electrical power development from the Mendoza River I learned from Mr. George Evans, one of the oldest and most prominent residents of Western Argentina. Mr. Evans is a civil engineer, and has long been in the service of the Transandine railway and the government. He claims no technical knowledge of electrical and hydraulic engineering, but for estimating on the fall, the feasibility of constructing intakes, ditches, etc., I should judge that he is quite sound. He has long had in mind the possibilities latent in the Mendoza River, and at the present moment has an application for a concession pending before the provincial government. Not knowing, however, whether he can secure the capital to push his scheme in the event of securing a concession, he seems somewhat reluctant to risk the money needed for preliminary expense. "It stands about like this," he said in a conversation we had concerning the matter; "I will have to spend at least $5,000 in 'palm grease' in order to obtain the concession, and before granting it the government will require a deposit of $20,000, or upwards, as a guarantee that work shall begin within a specified time. All this, of course, I would stand to lose. If I decide to accept the concession on these terms I will take the matter at once to London and see whom I can interest there; I am not oversanguine of meeting with success

FIG. 1.—MENDOZA RIVER AT AN ELEVATION OF 5000 FT.

in presenting the proposition in England, for it is something they know very little about over there, and they are very slow in taking up a new thing. The States, I suppose, would be the proper place to go with it, but I have no acquaintance there and, besides, I understand you have not a great deal of money as yet that is willing to go to new countries."

I might explain here that nothing is done—or even attempted—in Argentina without the use of "palm oil." There is no attempt made to cover up the practice and no attempt to check it. Every official in any wise involved in the granting of a concession has his price, and, although this is not quoted in the papers, in their stock reports, it is generally known and always has to be considered. Even the English-owned railroads have special funds set aside for no other purpose than "facilitating" favorable legislation.

The facts in regard to the Mendoza River are, briefly, as follows: For upwards of a hundred miles above where it emerges from the foothills of the Andes, near the city of Mendoza, this river has a fall ranging from 1.5 to 4 per cent and there is a large flow of water throughout the year. Exact figures on this flow I could not obtain, but in early May, the fall of the year, the time at which I was in that district, it was said to be at its lowest mark. At that time, at a certain point, it was about 100 ft. wide, from 2 ft. to 5 ft. deep, and flowing at a rate of from six to eight miles an hour. Possibly I can give a better idea of the river's fall in another way. The altitude of Mendoza is 2000 ft., and Las Cuevas, the terminus of the Transandine Railway on the main branch of the upper Mendoza, is close to 11,000 ft. Between these points is less than a hundred miles by railroad, and, I should judge, not more by river. A fall of 9000 ft. for so large a stream in so short a distance is not found in North America outside of Alaska.

The volume of the Mendoza at Las Cuevas is about one-fourth of that of the main stream at the point I first mentioned, and immediately below this station it falls 500 ft. or 600 ft. in what is practically a series of cascades. At this point a fall of 800 ft. could be obtained with half a mile of ditch paralleling the railroad track around the mountain. If it should be necessary to completely dam the river—which I doubt—in order to take out water, some provision would have to be made in the way of gates for drawing off the silt which this, in common with all other Andean streams, carries in suspension. Damming, if imperative, could be effected without great difficulty at several points where the river runs not over 10 ft. wide between high walls and with comparatively level open valleys above. I may also say that the general topography of the river valley is such that ditches could be kept to their general level along the hills without recourse to a great deal of tunneling.

FIG. 2.—MENDOZA RIVER AT AN ELEVATION OF 7000 FT.

As to finding a use for electrical power developed from this river there can be no question. The province of Mendoza is the greatest wine-growing district in the Western Hemisphere. It has a population of about 100,000, of which number 30,000 are in the city of that name. The enormous Italian and Spanish immigrations to Argentina have created an even greater demand for cheap wines that can be supplied, and the lower classes drink the wine of Mendoza simply because it can be supplied to them cheaper than the lowest grades of European wines. In spite of the low price which it brings in the market, however, the value of the wine produced in this province last year was close to $25,000,000 in American money.

FIG. 3.—MENDOZA RIVER AT AN ELEVATION OF 2000 FT.

Those well informed in Mendoza estimate that the two railroads—the Great Western and the Argentine Transandine—and the scores of wineries of that province and San Juan, all within easy transmitting distance, could find use for upwards of 250,000 horse-power, an amount which it is easily within the capacity of the river to supply.

Electricity in Peru.

BY EMILIO GUARINI.

On account of its economical, geographical and industrial conditions, Peru offers inviting possibilities for the applications of electricity. There are many large water powers which could be easily and economically utilized. It is true that here and there are coal deposits of great magnitude and very good quality, but means of transportation are so rare and nearly always so expensive that at only a few miles from the mines the price becomes prohibitive. On the other hand, the need of labor in sufficient quantity and at reasonable prices, makes itself felt more and more each day. For the present, at least, proper immigration cannot be counted upon. It is true that of late there has been a veritable Chinese invasion, but apart from the fact that these yellow immigrants remain in Lima, this kind of immigration is not at all desirable; principally, because of the gross lack of education among them. All of them become small retail merchants, and they are far from being honest in their trading.

On account of these facts, electric transmission with modern machines can become of great value. The industrial people of North America were quick to realize this, and they have made great efforts to put themselves on a solid basis in the Peruvian market. Their representatives, who speak Spanish, travel through the different regions and nearly always make acceptable conditions of sale.

As far as the electrical industry is concerned, it is only right to recognize that the United States owes a great deal to the efforts of Grace & Company, who represent the General Electric Company both in Peru and in the neighboring countries. At the present, however, various European electrical constructors also have representatives in Lima, the consequence of which has been the suppression of the nearly absolute monopoly that

was formerly held by Grace & Company, and a lowering, truly fortunate for the industry, of the price of electrical supplies and the cost of electro-mechanical installations. Previous to a few years ago nearly all the electricians and mechanicians were foreigners, mostly from North America. Now things are changing completely, with great advantage to the national industry. There have returned to Peru many young men who have been studying mechanical and electrical engineering in the United States. Furthermore, there has been established a national school of arts and trades, which turns out technical specialists and also workmen. In this school there is a section especially for electricians. Next year at the engineers' school there will be opened a special course in advanced electrical engineering.

To return to the interesting question of the electrical market in Peru, it should be added that the North Americans find, and will find, powerful competitors in the Germans. Whatever be the final result of this struggle, there is no doubt that it will be advantageous for the Peruvian industries. It is noteworthy, however, that the people of the United States have studied the local conditions better than have those in Europe, and the former people have more confidence in the brilliant future of this country. To illustrate, it is sufficient to say that while the General Electric Company constructed and sent to a gold mine at Santo Domingo in the interior of Peru a three-phase generator, rated at 300 hp, which could be transported by mule-back, many European houses stated that it was impossible to

FIG. 1.—VIEW OF GORGE AND GENERATING STATION AT CHARCANI.

construct a machine larger than 50 hp which could be transported in this manner. There were certain ones, who, instead of studying the special types, seriously advised the construction of special roads to make it possible to transport machinery by wagon.

There are electrical installations all over Peru which are more or less important. Electricity is used principally for public and private lighting and for application in the mines. Electric street railways have been used for city and interurban service only in Lima. As would naturally be supposed, the largest and most important installations are to be found in the neighborhood of Lima. For feeding its distribution system for lighting, power and traction, Lima possesses a number of hydraulic installations, which are probably the most notable in South America.

At present there are two hydro-electric stations and one auxiliary steam station. The first is constructed at the foot of the Andes, and is that of Chosico; it utilizes a fall of 40 meters and a flow of 5 cubic meters per second. The second is at Lima, and utilizes a fall of 25 meters. The Chosico station is about 40 kilometers from Lima. The water is conducted from a concrete dam constructed 200 meters above the station, by a canal 3 meters deep and 8 meters wide; this canal ends in a reservoir where sand and gravel is allowed to accumulate. The water drives three groups of three-phase generators which produce current at 2300 volts, and the transformers raise the e. m. f. to 33,500 volts. At this e. m. f. energy is transmitted to Lima by two independent lines. The poles are made of white cedar, and are from 9 to 10 meters long. The central station of Polvora (Lima), which also serves as a sub-station for the Chosico station, is fed by a reservoir having

FIG. 2.—STORAGE BATTERY AUTOMOBILE.

a capacity of 54,000 cubic meters, and through a penstock 600 meters long and 75 centimeters in diameter. In the steam auxiliary plant there is, among others, a Curtis turbine rated at 1000 hp; crude petroleum is used as fuel.

There are three sub-stations; one at Legria to feed the Lima-Callao Railway; one at Miraflores to feed the Lima-Chorrillos Railway, and one at Lima for the city railways. At Polvora the e. m. f. is reduced to 10,000 volts; the second transformation reduces it to 2080 volts, and the last to 104 volts, which is the e. m. f. of the distribution system.

Arc lamps in series and incandescent lamps are used for the public lighting in Lima. In private lighting, the flat rate of $1.00 a month for each 16-cp lamp prevails. Previously, for different reasons, people have been more or less opposed to the introduction of the watt-hour meter, but now they are becoming more reasonable. By the meter method, energy is sold at 15 cents per kw-hour, while the hp-month costs from $3 to $4, according to the rating of the installation and the number of hours of use per day.

In general, the installations which are in service demand many urgent reforms. This will be possible now that several of the enterprises have united to form a trust. The companies do not receive all the profit that they could from the stations. Besides introducing desirable modifications in the present lighting and power service, they will be able, advantageously, to enter the true field of electrical industry, that is, electrical refining. The city railways of Callao and of Chorrillos will be

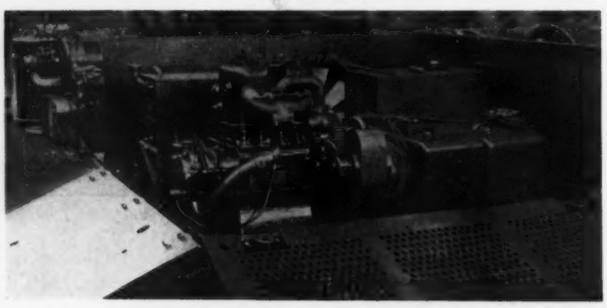


FIG. 3.—GENERATOR UNIT FOR CHARGING THE BATTERIES.

merged in the trust. The first has a network of 38 kilometers and began operation with 35 cars, which number has recently been increased. The Callao Railway is 14 kilometers long, and the Chorrillos Railway, 16 kilometers long. The capital of the trust is about $11,000,000. At present a loan of $5,000,000 is being negotiated for increasing and improving their instal-

lations. In a few months the electrical trust will have finished its third hydraulic station at Chaora Sana, 4 kilometers below the Chosico station. It will utilize the same waters of the Reisnac. It is expected in this manner to develop 6000 addition horse-power with which it will be possible to introduce certain desirable changes in the service and, probably, also, to lower the prices. It may be added that the electrical trust has lately leased for a term of years the steam railway between Callao and Chorrillos, a distance of 30 kilometers. It will pay

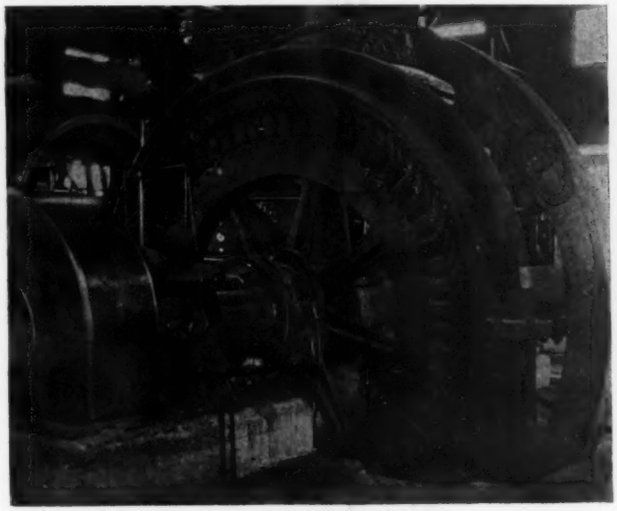


FIG. 4.—THREE-PHASE GENERATOR AT SMELTER.

$70,000 a year, and after having electrified it, much better service will be established for the transportation of freight.

In a short time, also, the railway of the Compañia Nacional de Tranvia Electrico, which, in addition to its city service, will inaugurate a service between Lima and Herradura, three kilometers beyond Chorrillos. The central station is finished and the line is almost completed. The capacity of the central station at Miraflores will be increased by about 1000 hp. The electrical apparatus was furnished for the most part by Siemans-Schuckert, of Berlin. Internal combustion engines are used with crude petroleum as fuel. The installations of this last company have cost up to the present moment about $750,000.

At Arequipa the electric generators which furnish electricity principally for lighting are driven by turbines which receive water from the Chili, under a head of 26.5 meters, through a canal 1900 meters long. The flow of water is about 4 cubic meters per second, corresponding to a gross power of 1413.33 hp, or 1060 hp net, at the turbine shafts.

The station built by the Sociedad Electrica is located at Charcani at a distance of 13 kilometers from the city of Arequipa. It contains two turbo-alternator units, 248 hp each. The turbines require 865 liters of water per second, and the generators produce alternating current at 5400 volts and a frequency of 50 cycles per second. The third unit, rated at 538 hp, which produces three-phase current at the same voltage and frequency, is connected to the power network during the day, and the lighting network during the night. The station at Charcani represents altogether about 1000 hp, or about 730 kw, which is transmitted to a sub-station in Arequipa over a line 12.5 kilometers long, consisting of 8 wires, each having a cross section of 16 sq. cm. carried on 240 poles. The fall of potential in the line is relatively large. Taking into account the loss in the transformation and in the distribution system, the useful power amounts to about 80 per cent of that produced at the station; or,

$$\frac{80 \times 75}{100 \times 100} = 60 \text{ per cent}$$

of the power in the water. These results may be considered as satisfactory, and the hydro-electric station at Charcani is certainly under present conditions one of the best in the country.

For a couple of years experiments have been made at Lima with storage-battery omnibuses, using an American system. The results have been disastrous. The cars were poorly conceived and badly calculated. They were provided with two 2-hp motors, absolutely insufficient to give a moderate speed to a mass of seven tons (passengers included). The storage batteries were ruined in a few months. At present the writer is changing the motive power from storage-battery to the gas-electric system. The car is running very well at present, and will run better still when the electric motors have been changed. The electrical part of the equipment has not been changed; the batteries have simply been replaced by two dynamos and an alcohol motor. The two dynamos can be connected in series or in parallel, as was formerly the case with the two batteries.

Haocho possesses a modest hydro-electric installation, much like that in Porato, at Trujillo. It was installed by the Peruvian representative of Sieman-Schuckert. This last installation was made in 1903. The canal is 2400 meters long, and has a capacity of 1000 meters per second. The fall utilized is 61 meters, the penstocks being 180 meters long and 65 meters in diameter. The station contains two 250-hp units, which produce three-phase current that is transformed to 10,000 volts and used for transmission to Trujillo by a line 35 kilometers long; there being three conductors each 10 sq. mm. in section. The insulators were tested at 40,000 volts. At Trujillo the e. m. f. is stepped down to 220 volts, which is that of the distribution system. The entire installation, which cost $90,000, feeds, besides a few electric motors, 1770 private lamps and 470 lamps for public lighting. In the valley of the Tambo at the works (sugar factory) of M. Lira, is installed a modest electrical installation which during the day supplements the hydraulic power, and during the night lights the factory and the neighboring dwellings.

At Cerro de Pasco, Mr. Solomon Tello, has a small hydro-electric installation for the public and private lighting of this important mining center. Because of the insufficiency and the intermittent character of the flow of the water, this gentleman is building at present another station in which the supply of water will be more constant.

In the same region is located the Rio Blanco station of the Italian mine owner Fernandini, and that of the Cerro de Pasco

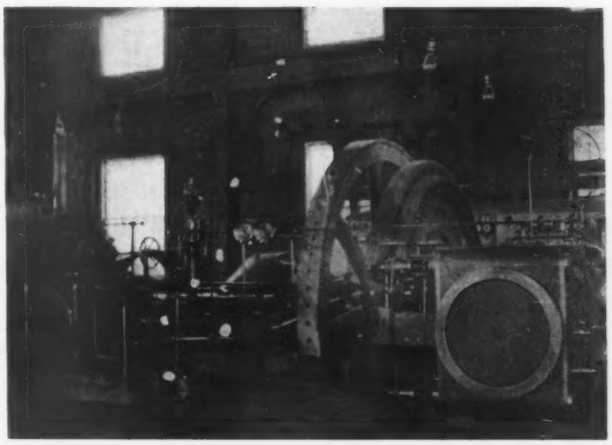


FIG. 5.—GENERAL VIEW OF ENGINE ROOM AT SMELTER.

Mining Company. The former contains two three-phase, 700-hp units. The high-tension system, having a total length of 22 kilometers, passes through the mines and the foundry and ends at Cerro de Pasco. The installations of the Cerro de Pasco Mining Company are located at Smelter, about 25 kilometers from Cerro de Pasco. Because of the coal deposits in the neighborhood, steam-power, instead of water-power, is used in this plant. This was not done because of the lack of water-power, but simply to save time. It would, evidently, be desirable to diminish the expenses by constructing a hydraulic

station, leaving the present steam station to act as an auxiliary. In the power station is a Westinghouse three-phase, 440-kw generator coupled directly to a Norberg cross-compound engine, and a 50-kw direct-current generator to supply electricity for the laboratories. In a short time it is expected to double the capacity of these stations. When the stations are finished, the total installed power wil' be 1600 kw. In all electrical installations around Cerro de Pasco great precautions had to be taken to avoid the disastrous effects of atmospheric electricity, the altitude being 4000 meters.

The installation which holds the world's record for altitude is a small 25-hp hydro-electric station which supplies energy to the Alpamina mine. This line is more than 5000 meters above the level of the sea. The electricity is generated directly at 3000 volts and transmitted about 8 kilometers.

In addition to the above mentioned installations there are a great number of electric mining stations. The writer estimates the aggregate ratings of the electrical machinery installed in Peru as about 50,000 hp. Under the favorable conditions which the electrical industry meets in Peru, doubtless it will be greatly increased.

A Year's Operation of the Highest Working Voltage in the World.*

By F. E. Greenman.

The Grand Rapids-Muskegon Power Company has been operating its transmission line at 72,000 volts for the past year, with results far beyond expectation.†

This transmission line extends from Roger's Dam, located six miles south of Big Rapids in a southerly direction, to the Casnovia switch house, 40 miles from the dam, where the line branches to Grand Rapids, 26 miles south and Muskegon, 26 miles west, making a total of 92 miles, located entirely upon private right of way, four rods wide, cleared of all trees and underbrush and a large portion fenced. Considerable care was used in obtaining the right of way to get the longest possible tangents and moderate grades. Almost the entire distance from Roger's Dam to Croton, the line runs through the pine stump land which only a few years ago helped make Michigan famous; but now is a dreary waste of blackened stumps and brambles.

In order to have the line properly patrolled, it was necessary to construct a well-made road bed over a greater portion of the right of way; care being used to have it properly drained so that it could be depended upon in all kinds of weather.

In construction, wooden poles were used exclusively, carefully selected, varying in length from 35 to 75 ft. with diameter of tops from 8 ins. to 12 ins. The special 8-ft. and 5-ft. crossarms were employed, spaced 5-ft. apart, as in Fig. 1, and carrying three 14-in., 4-part insulators, as shown in Fig. 2, mounted on 18-in. wooden pins except on corners and angles, where a galvanized steel tubular pin with cast lead thread forms the pole construction.

No. 2 medium hard-drawn bare copper was used for line conductors together with No. 10 galvanized iron wire grounded every fifth pole for lightning protection.

The 72,000-volt switches used at the dams, switch house and sub-station, were designed and constructed under the direction of Mr. J. B. Foote. The construction is shown in Fig. 3. They are mounted in a wooden case, made as nearly oil-tight as possible, and the case is enclosed in a galvanized iron tank. The finger contacts are mounted on 40,000 volt insulators, placed in opposite corners of the case. A heavy wooden block is so placed in the other corners of the case as to allow the switch-blade a throw of 90 deg. This blade is mounted in the center on a wooden shaft, insulated with porcelain bushings; the shaft extends through the top of the case, where one of the four bevelled gears which operates the device is attached, as shown in the sketch. These switches have given perfect satisfaction, combining two very desirable features—maximum efficiency and minimum cost. Three sets of these switches are located at the Casnovia switch house, so that either the Grand Rapids or Muskegon, or both branches, may be cut out at the will of the operator in case of trouble or for testing purposes.

The patrolling of the line has been done by two men, one located at Roger's Dam, patrolling to the Casnovia switch house, and the second located at the Casnovia switch house, patrolling the Grand Rapids and Muskegon branch alternately. This arrangement has been found quite satisfactory, the entire line being covered four times each week. Each man is equipped with a good, strong, specially made buggy, of sufficient size to carry three or four high-tension insulators together with pins, portable telephone, etc. In order to keep in touch with patrolmen when on the line, they call the Grand Rapids sub-station every half hour over the private telephone line. Thus in case they are needed on short notice they can be easily communicated with.

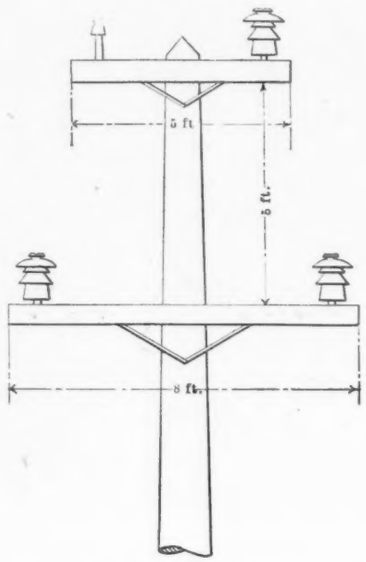


FIG. 1.—ARRANGEMENT OF CROSS-ARMS.

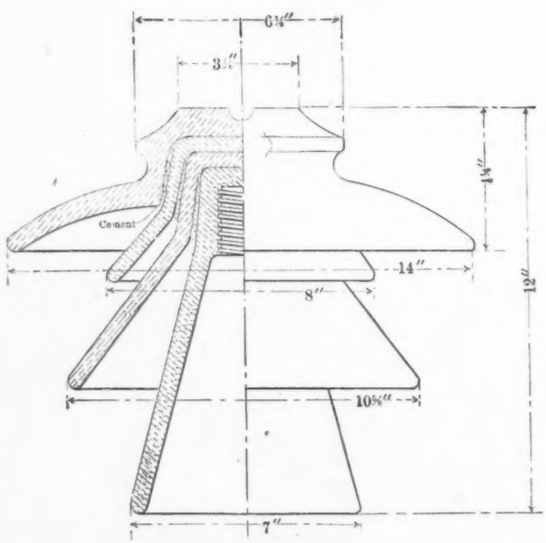


FIG. 2.—PART SECTIONAL ELEVATION OF INSULATOR.

The usual amount of trouble caused by insulators being broken by stones and guns was experienced during the first few months, but after several of the culprits were caught and punished in the courts, very little trouble was had, and in the above cases very little damage was done beyond the replacing of an insulator. We find, as with all high-tension transmission lines,

*Paper read at the Michigan Electric Association Convention, Aug. 20, 1907.

†For photographs of this line see Electrical World for Nov. 3, 1906.

lightning is the greatest enemy; but by comparison no greater difficulty has been experienced than with lines operating at 20,000 volts, presumably because of the higher insulation used at 72,000 volts.

During the year there were two total interruptions caused by lightning demolishing insulators. On two occasions wires were thrown across the line, and one interruption was caused by a broken pin, allowing a wire to rest on the cross-arm, which it burned off. In connection with the last named interruption, the static discharge from the line is gradually charring the wooden pins. While this is not sufficient to cause alarm, Mr. Foote is making preparation to replace them with galvanized steel tubular pins, such as now used on corners, as soon as convenient.

No difficulty has been found with leaking insulators not broken or cracked, as seems to have been experienced on other lines, although in some localities they have been put to a very severe test, such as a portion of the line passing plaster or gypsum mills where everything is covered with the white gypsum dust. The writer has noticed on several different occasions that the insulators were practically covered, petticoats and tops, and at this particular place there are two sharp turns and a railroad crossing where all poles are double armed. Still there has been very little discharge, if any—at least no more than could be found on close inspection of a clean, dry insulator. Such discharge is, of course, more noticeable during weather that is cold and dry than when it is warm and damp, for the reason that the static or leakage is absorbed and diffused in a humid atmosphere, whereas in dry, cold weather, it must be condensed until of sufficient voltage to jump the gaps necessary to reach the pin.

DISCUSSION.

Following the reading of Mr. Greenman's paper many questions were asked of the author which brought out the following points:

A telephone circuit is operated satisfactorily on the main pole line. This telephone line is the best tell-tale of trouble the company has and gives the first warning of leaky insulators. The line has been operated for 14 months at 72,000 volts. Loss from power-house bus-bars to customers' 440-volt meters is 23.5

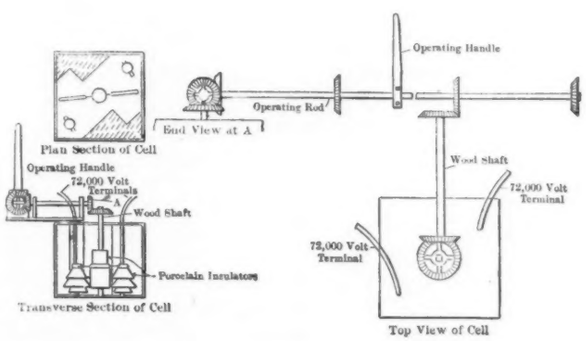


FIG. 3.—ARRANGEMENT OF SWITCHES.

per cent average. The losses included in the 23.5 per cent are those in the step-up transformers, high-tension line, step-down transformers at city limits and a second set of step-down transformers at the customers' meters. Meters were checked by the Electrical Testing Laboratories of New York. On the new steel tower line the company is now building the suspension type of insulator is to be used, the line being designed for operation at 100,000 volts. One man caught breaking insulators has been sent to the penitentiary for one year. The judge was inclined to be severe because of the great amount of loss of time and the shutting down of manufacturing industries caused by the wanton breakage of insulators. The grounded wire run along the top cross-arm is a plain No. 10 iron wire, which is grounded by means of coils of iron wire buried under the poles. The telephone line is 12 ft. below the transmission line. To use the telephone, operators must stand on an insulated platform. When linemen telephone in, they do it by means of a portable testing set, which they carry up the pole. The static charge accumulating either on telephone or high-tension line wires when the wind is blowing is sufficient to give severe shocks, even when the line is dead. Copper wire is used rather than aluminum on account of its strength. It is easy to tell the difference between insulators broken by stones or bullets and those broken by lightning. Those broken by lightning are fused.

Direct-Current Turbo-Generators.

When a turbine-driven direct-current generator is operated in parallel with generators driven by reciprocating engines, the turbine-driven generator ordinarily has a better speed regulation, and because of its greater speed, is so designed that its armature and series field windings have less self-induction. The turbine-driven generator may be compounded so as to

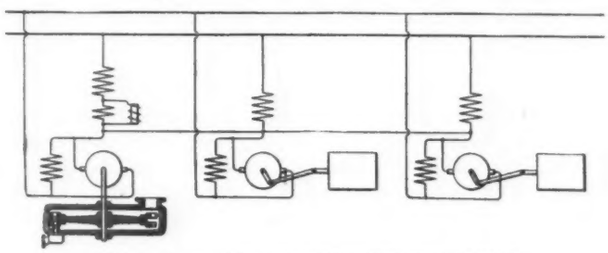


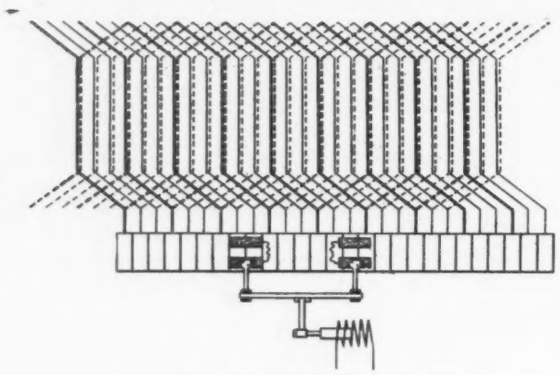
DIAGRAM OF PARALLEL-CONNECTED GENERATORS.

divide the load equally with the other generators under ordinary load variations; but upon the occurrence of a short-circuit or heavy overload, the turbine-driven generator takes the greater part of the load, both because of its better speed regulation and on account of its lower self-induction, so that it may be damaged by excessive current before the circuit-breaker in series with all the generators opens. The accompanying illustration shows a scheme for preventing the proportionate increase of load on the turbine-driven generator when subjected to short-circuit which was patented on Aug. 20 by Mr. E. J. Berg. Automatic means are provided for reducing the relative strength of the field of the generator when the load current suddenly increases. The turbine-driven generator is provided with a series winding, whose m. m. f. tends to oppose the main field magnetization, this winding being shunted by a reactive coil of low resistance. Normally, this opposing series winding carries only a small portion of the load current, but on a sudden increase of load, the self-induction of the reactive coil causes the greater part of the increase of current to flow through the opposing field winding of the generator, thereby momentarily reducing the generator field strength so as to prevent the generator from assuming more than its share of the overload, and to give the circuit-breaker time to open.

Prevention of Sparking in Alternating-Current Commutator Motors.

A method that has frequently been proposed for preventing sparking in an alternating-current commutator motor consists in providing the armature with two or more distinct windings connected to successive commutator segments, and employing brushes of such width as not to bridge two segments connected to the same winding. The above method is effective at starting and at low speeds, but it is disadvantageous at high speeds when interruptions in the current in individual windings occur with great rapidity and produce serious sparking. At high speeds a single armature winding is satisfactory because both the armature current and the field strength are small in value. On July 23, a patent was granted to Mr. Marius C. A. Latour on means for combining in one structure a machine that acts at starting as though there were a plurality of dis-

tinct armature windings and operates at full speed as though there were a single armature winding. The arrangement proposed is shown in the accompanying illustration. At each commutating point there are two brushes, each brush being of a width insufficient to bridge two segments connected to the same winding. At starting, the two brushes are in line, so



MEANS FOR PREVENTING SPARKING.

that the machine starts like a motor with a plurality of windings and a single set of narrow brushes. When the motor is up to speed one brush is shifted so that the two which are in electrical connection have together sufficient width to bridge two segments connected to the same winding.

New Telephone Patents.

MEANS FOR EXTENDING TRANSMISSION.

Now that the extension of the limit of telephone transmission through the use of the Pupin coils is well known, it is but natural that simpler methods of accomplishing equivalent results should be sought. The Pupin coils are in practical form rather bulky and space must be provided for them at regular and stated intervals. Of course, the next step in advance would be the production of a uniform conductor with the proper relation of capacity and inductance to gain the same advantage as with the coils. Mr. W. C. Yeatman, of Chicago, has patented a conductor upon this design. He uses a copper core and deposits upon this electrolytically a continuous shell of iron to a determined thickness. He then passes a continuous current over the line so that the permeability will be high, obtaining thus a considerable inductive effect. In his specification, Mr. Yeatman assumes a conductor of No. 16 copper in a paper cable of usual constants and compares this with an equivalent cable of compound conductor in which the copper core is No. 16 gauge having a coating of iron .006 in. thick, and carrying a steady current of .1 ampere. He finds that, assuming a 100-mile length of cable, at a frequency of 1000 p. p. s., the latter

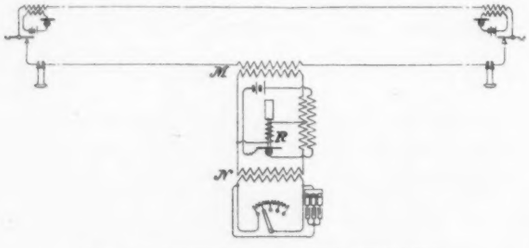


FIG. 1.—SHREEVE TELEPHONE REPEATER.

will conduct 132 times as much of the impressed energy as the all-copper cable, which corresponds to a gain of three and one-half times for commercial transmission.

An entirely different method of extending transmission, namely, the repeater, is the subject of a patent granted to H. E. Shreeve, of Newton, Mass. This patent relates to the method of associating the repeating and main circuits. In such cases a repeating induction coil is used, and it has been customary so to connect this that the receiving circuit of the repeater is bridged across the line. In this case the successful transmission depends upon this bridge being very close to the electrical middle of the line. The new arrangement is shown in Fig. 1. Here the repeating coil *M*, in series with the line, forms the link between the repeater and line circuits. The similar coil *N* forms the balancing branch, the exact balance being obtained by adjustments of the artificial line. The necessity for balance will be understood when it is appreciated that the receiving circuit *R* must connect equipotential points, for all currents generated by the transmitting end of the repeater.

Both of the above patents have been assigned to the American Telephone & Telegraph Company.

NEW SWITCHBOARD CIRCUITS.

In the line of new switchboard circuits we have a two-wire system of the Dunbar type in which the cut-on relay is bridged across the line and the supervisory relay is wound differentially. The line relay coil is left connected in the line and its contact circuits are so changed by the cut-on relay that the line lamp becomes extinguished and a resistance controlling the supervisory relay is connected to the back contact of the line relay. This circuit is patented by W. W. Dean, the patent being assigned to the Kellogg Switchboard & Supply Company.

Another system making use of the differential relay has been patented by M. S. Conner, of Rochester, and assigned to the Stromberg-Carlson Company. In this case the cut-on relay is in series with the line when a call is being made, the current passing through the two windings in differential relation. When a plug is in the jack, the balance is upset and the relay operates, thus connecting the line to the jacks and incidentally short-circuiting one of the relay windings.

A trunking system is the subject of C. S. Winston's invention. The patent covers the broad use of a three-point jack plug and cord at the outgoing end, the third strand for signaling purposes, with a two-strand cord and plug on the incoming end. This patent is assigned to the Kellogg Company.

NEW APPARATUS.

With two-pole receivers it is customary to confine the field area to the middle of the diaphragm. To this end the two

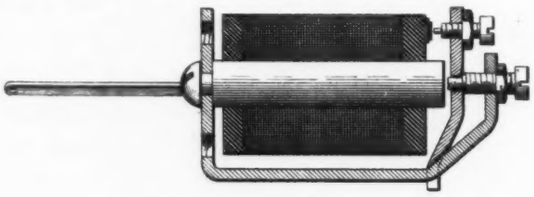


FIG. 2.—MC BERTY RELAY.

polar extremities of the horseshoe magnet are close together and both carry coils. In the receiver now patented by W. R. Bankhead, of Bremerton, Wash., the diaphragm is all in the magnetic circuit, its support forming one polar extremity and a single large section spoke leading from it to the polarizing magnet. A single round pole, carrying the receiver coil, extends from the other pole to a point opposite the middle of the diaphragm.

Fig. 2 shows in section a relay patented by F. R. McBerty. The part covered by the present patent is the adjusting means, the novelty lying in the armature-guiding stud projecting from the end of the back stop screw. This stud keeps the armature from jarring off its seat.

E. B. Craft has invented a self-contained hook switch, the lever being a bell crank pivoted at the angle, the springs being moved by the short arm. The downward motion of the lever is stopped by the lever striking a short stud extending out from the base plate and beneath the lever. The upward motion is limited by the short arm of the lever striking the base plate. The last two patents have been assigned to the Western Electric Company.

Rather a novel receiver support has been patented by W. J.

Mogridge, of Spokane, Wash. The receiver supporting arm has a hinge arranged about the middle of its length. This hinge will only bend upward, and when the receiver is thrown upward after conversation, the front part of the arm guides it to a rest piece. This latter is secured to the hook switch, which operates under the weight of the receiver.

Two patents have been granted to F. B. Cook, of Chicago, covering a new type of pole cable terminal. The arresters for this are made up in units for one line and may be mounted on the terminal as needed, having facilities for connection with the line terminals. With a multiple terminal cable system, it is only necessary to mount an arrester at that terminal of a line where it is actually used. It will be seen that a saving is effected as there are no idle spare protectors.

TESTING APPARATUS.

For testing and patching toll lines, it is customary to provide a test board with a number of jack terminals for each line. These provide facilities for testing for connecting on a branch line, for connecting in desired extra apparatus, for patching, etc. These jacks must be wired in several different relations to the lines, and they require a large test board for mounting. Messrs. T. A. and W. P. Hammond, of Passaic, N. J., have devised an arrangement whereby each line is provided with but one permanent jack. The additional testing jacks required are associated in the base of a plug which fits the permanent jack.

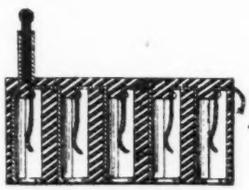


FIG. 3.—HAMMOND JACK.

FIG. 4.—LEWIS CONNECTOR.

These plug combinations may be of different construction to provide jack groups for the individual test requirements. For example, if a looping bridge is desired, a three-jack combination is plugged into the desired line jack. Perhaps a better idea of the arrangement may be had from Fig. 3.

Another patent for testing apparatus has been granted to G. G. Butler, of Oklahoma. This is a test box containing apparatus arranged to accomplish with facility the various customary tests. His patent covers the details of his arrangement.

In Fig. 4 is shown a novel idea in the form of a connector for attaching a branch line to a main line without severing the main line. The use of the device is understood from an inspection of the cut. O. E. Lewis, of Ulysses, Neb., is the patentee.

In most ringing systems using a polarized bell, resort is had to alternating or impulse generators. W. W. Kidney, of Buffalo, has invented a selective system using vibrating polarized bells rung from a battery or other source of steady current. Fig. 5 shows the arrangement of circuits for two stations. It will be seen that normally a condenser is in circuit with each

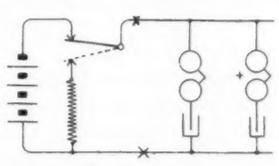


FIG. 5.—REED SELECTIVE SYSTEM.

ringer, and each is poled to respond to its own direction of current. It will be seen that the arriving current in charging the condenser causes a kick of the armature, which in turn discharges the condenser, assisting the bias spring. A vibration results. Current of the prong polarity fails to give any initial kick to the armature. The patent for this system has been assigned to the Century Telephone Construction Company.

A diagram illustrating the principles of another system is shown in Fig. 6. This system has been patented by S. A. Reed, of New York City. The bells are biased and polarized, the arm F being vibrated from an outside source. It will be seen that the condensers are rapidly charged through the bells on short circuit and discharged through the bells in series with the high resistance coil. The ratio of parts is such that an entering impulse is sufficient to kick the armatures of the bells against the bias spring, and such action takes place where the poling is

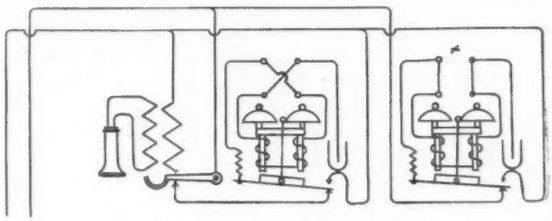


FIG. 6.—KIDNEY SELECTIVE SYSTEM.

correct. The discharged current on the other hand is drawn out by the resistance to a point such that its instantaneous value is never sufficient to start an armature. Thus selection takes place.

A magneto system dispensing with the station hand-generators is the subject of a patent granted to H. M. Eldred, of Milwaukee. A grounded generator is connected to each line through its line drop, so that grounding the line at the station is sufficient to set the line signal. Rings toward the station are metallic. It is probable that such a system would suffer materially from the effects of leakage and induction.

NEW APPARATUS.

A combined jack and drop forms the subject of a patent granted to J. M. Overshiner, of Chicago. A small cam lever projects forward from the mounting plate beneath the shutter and it forms a stop for the shutter. A ring raised upon the shank of a plug rides under the cam lever and raises it. This drives the shutter up to the locked position. The lever is very small, and its action requires no conducting contact between plug and shutter.

Polarized bells are usually built upon a frame. W. Kaisling, of Chicago, has used the cores of the magnets in lieu of this, and supports the armature yoke in annular grooves cut in ruts which engage the threaded ends of the cores. By this means an adjustment is effected. The yoke of the magnets provides a support for the bell posts, for the polarizing magnets and also a means of mounting.

LETTER TO THE EDITORS.

Standardization of Scientific Notation.

To the Editors of the Electrical World:

SIRS:—It seems to me that the time is ripe for the standardization of notations used in electrical engineering. Everyone must agree that it is much easier to read and understand calcalculations and theoretical articles, when the notation accords with the familiar forms. At the present time, however, there is quite a lack of uniformity even in such designations as are used for voltage, current, number of phases, cycles, poles, etc. The Standardization Committee of the American Institute of Electrical Engineers has apparently recognized the importance of standardization in notations, and in its latest report a few rules on this subject are set forth, but rules are desirable, covering more or less broadly all notations used in electrical engineering. For example, in the works of Prof. E. Arnold, having become once familiar with his notation, it is easy to read any of his writings, because each particular character has a certain meaning, always the same, no matter in what part of book or in what book it is cited. Returning to the Standardization rules, as they are printed in the July A. I. E. E. *Proceedings*, we find on two adjoining pages (1081 and 1082), that the character p desig-

nates power factor, percentage of saturation and velocity ratio.

The reader of the technical press is quite embarrassed sometimes by this lack of uniformity in writing formulas, as the following examples will illustrate:

In The Electrical World (March 30th), we find a very interesting article on the "Leakage Reactance of Induction Motors," by Mr. I. E. Hanssen. This article, by-the-way, represents practically an abstract from Prof. Adams' papers and, to some extent, Prof. Arnold's books, although the author introduces some deductions of his own. This is a very desirable kind of an article for an electrical journal, because it represents in a clear and compact form formulas necessary for practical calculations. Carelessness with the notation, however, nullifies this benefit to some extent. First of all, all of Prof. Adams' notations are changed without any apparent reason, and the author fails to explain what some of his own notations mean, as, for example, what q and p in formulas for end connection and belt leakage mean. Probably p designates the number of slots per pole and q the coil pitch, but then it becomes difficult to understand why end connection leakage depends only upon the number of slots per pole, no matter now long and how thick these connections are. Referring to Prof. Arnold's treatise, we find a beautiful deduction of the formula, where this leakage is expressed by means of the $\log_{10} \frac{l_s}{d_s}$ (designating by l_s the length of the end connection, and by d_s the diameter of the circle whose circumference is equal to the perimeter of the cross-section of the coil end). This expression is strictly in accordance with the theory and apparently cannot be successfully replaced by any single "machine dimension." Log $_e$, used in this case by Prof. Adams, is not very convenient for practical calculations. Further, if q is slot pitch, then it becomes impossible to find why Mr. Hanssen replaces γ^2 in Prof. Adams' expression for belt leakage by D and q^2. Probably D^2 is intended.

In the proposed A. I. E. E. "Code of Ethics" there is a very good rule, as follows:

"31. He [the electrical engineer] should assist his fellow engineers by exchange of general information, experience, instruction, etc."

Which might be extended by the addition: "And he should have care that all possible errors in his information, instructions, etc., be eliminated."

I return to Mr. Hanssen's article. I do not see why in citing Prof. Adams' expression for slot constant, he omits the multiplying factor, $\frac{3.2}{S\ I_0 + depth}$ with no explanation, retaining, however, the name "slot constant" for his formula. It seems to me that there will be as many different slot constants as there are technical writers on the subject. There is also a mistake in the above formula, $\frac{2h}{ag}$ should be $\frac{2h}{a+g}$. In the next formula (for zigzag leakage) we find $\frac{t_{01}\, t_{11}}{2Q}$ instead of $\frac{t_{01}+t_{11}}{2Q}$. In the last equation (6) coefficient 20 refers to all expressions in a parenthesis. This is apparently wrong, because some expressions already contain factor $\left(\frac{4\pi}{10}\right)$ which comes into coefficient 20. If this coefficient refers to the slot leakage only, which is very likely, considering formula (2), then we have the rest of formula (6) expressed per cm. length of core, there being no factor 2.54 for them, which is apparent from formula (3). Formula (5), after being transferred into general equation (6), appears (without any reason) again multiplied by S_0.

I suggest also, that all such expressions as π, 2π, $\sqrt{2}$, $\sqrt{3}$, etc., should retain their original appearance, because then formulæ become clearer and easier to understand, and that also inductance and coefficient of self-induction should not be designated by the same character.

East Pittsburg, Pa. J. P. Nikonow.

[Mr. Hanssen called attention to some of the above-mentioned omissions in a letter which appeared in our issue for June 22.—Eds.]

DIGEST OF CURRENT ELECTRICAL LITERATURE.

Dynamos, Motors, and Transformers.

Single-Phase Commutator Motor.—An illustrated description of the Deri repulsion motor built by Brown, Boveri & Company. The left-hand diagram of Fig. 1 shows the ordinary repulsion motor, the right-hand diagram the Deri repulsion motor.

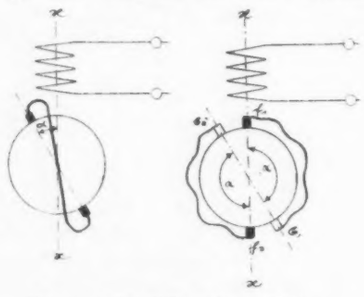


FIG. 1.—DERI REPULSION MOTOR.

There are two sets of brushes. The brushes b^1b^2, insulated from each other, are mounted on a common brush holder. The brushes f_1f_2 are mounted on a second brush holder which is independent of the other. The brushes f_1f_2 remain stationary at their places in the axle of the stator winding while the set of brushes b_1b_2 can be moved. The bushes b_1f_1 are short-circuited by means of a flexible cable; in the same way b_2f_2 are short-circuited. By the displacement of the one set of brushes is a very simple means to regulate the motor. Its behavior is explainel and some illustrations are given of motors actually built on this principle.—*Elek. Zeit.*, Aug. 15.

Alternator Design.—W. Chappell and T. Germann.—A paper illustrated by numerous diagrams on the size, weights and costs of alternators as effected by the rated speed and periodicity. From a comparison of a number of designs the general conclusion is arrived at that for machines of equal output, the high-speed, low-frequency machine is the best as regards ease in designing, weight, and initial cost as well as requiring lighter foundations, with less initial cost, and considerably less headroom.—Lond. *Elec. Eng'ing*, Aug. 22.

Loading of Transformers.—A. F. Gustrin.—A translation in abstract of his German paper on a new method for the artificial loading of transformers which has already been noticed in the Digest.—Lond. *Elec.*, Aug. 16.

Lamps and Lighting.

Train Lighting.—H. Henderson.—An illustrated paper in which the author discusses the problem of lighting railway carriages by electricity. After giving particulars as to the cost of the equipment and maintenance he proceeds to describe the various systems which have been proposed and in a few cases adopted. The systems specially described are those of Stone, Vickers & Hall, Moskowitz and Vicarino. The following conclusions are arrived at. Moving parts must be confined to the armature of the dynamo, one commutator being sufficient to have to keep in order. The addition of motors or motor-driven regulators adds chances of breakdown and increases the cost of maintenance, at the same time adding complicated connections which would easily baffle an ordinary electrical work

man. The pole-changing devices should be in the form of a reversing switch, and not obtained by revolving the brushes. Electrical switching is the safest from the point of view of preventing the batteries sending a reverse current through the armature should the dynamo fail to excite. The switch should be first operated by a shunt coil connected across the dynamo or in series with the field-magnet circuit, as is done in the Vickers-Hall, Moskowitz, Vicarino and Leitner-Lucas systems. On the other hand, mechanical switching has been found reliable, and the number of cases of failure of the dynamo to excite is very small. The voltage should be regulated electrically, thus giving a more efficient working of the dynamo. The use of high-efficiency lamps with metallic filaments would be a great saving in power and first costs of all parts, and this part of the business should be looked into if successful competition is to be carried out against incandescent gas. In bogie coaches, wherever possible, the dynamo should be attached to the bogie, this method of fixing being better for running round curves.—Lond. *Elec.*, Aug. 16, 23.

Future of Electric Lighting.—G. KLINGENBERG.—The author first discusses the underlying principle of the maximum demand system of charging and states that the so-called double tariff has found extended application in Germany, the normal rate being charged at times of maximum load and a much smaller rate at other times. In contradistinction to American practice it has become usual in the last 10 years in Europe to design direct-current works for 2 x 220 volts. The argument is that the lower efficiency of the 220-volt lamps is more than compensated by the saving in interest and depreciation in the cost of the network. Concerning the life of 220-volt lamps he says that the results obtained have been good, probably because the voltage variations in 220-volt networks are smaller than in 110-volt networks. The Nernst lamp is very suitable for 220-volt networks. The author then discusses the new metallic-filament lamps, and points out that on account of their smaller sensibility with respect to voltage variations and their greater overload capacity the line may be designed for a larger voltage drop than is usually admitted at present. At present metallic-filament lamps are made for not more than 110 volts, and upon inquiry the majority of the managers of central stations have expressed their preference for reducing the voltage again to 110. At 110 volts smaller units of light can be used, the efficiency of the lamps is better, and half as many arc lamps can be connected in series as at 220 volts. On the other hand, at 220 volts the first cost of the network is considerably smaller, and it is possible to supply energy to districts where the demand is relatively small. It seems that it will be possible to make new metallic-filament lamps for 220 volts, but that they are not expected to give as good results. The author, nevertheless, thinks that the high voltage of 220 should be retained. In three-phase plants the four-wire system has great advantages over the three-wire system, and the author thinks that three-phase systems should be arranged for 3 x 120 volts in star connection with a neutral wire. In the manufacture of arc lamps small lamps, such as for two amperes and 110 volts, have recently been introduced, but in this field the arc lamp will meet strong competition from the new metallic-filament lamps, and the author thinks that arc lamps should not be built in units smaller than 500 candle-power. Some notes are given on the development of the flame-arc lamp. An important progress made by its introduction is that the alternating-current system has become equal to the direct current system. It is now possible to vary, to some extent, the color effect, but the cost is higher. Not only do the carbons cost more, but there is an increase in the cost of maintenance, which is quite considerable. According to the experience of a large German electric station using flame-arc lamps for 16 hours the increase of cost of maintenance per lamp hour is 0.5 cents for wages, 1 to 1.25 cents for higher cost of carbons and 0.75 cents for repairs, etc.—*Elek. Zeit.*, Aug. 15.

Transformation of Energy Into Light.—C. E. GUILLAUME.—A report presented to the French Association for the Advancement of Science. The author first discusses the radiation loss and then deals with the definition of luminous efficiency. The definition as the ratio of the watts within the visible spectrum to the total watts of radiation is considered to be unsatisfactory, since it does not take the physiological effect into consideration. He proposes another definition which takes the varying sensibility of the eye toward different wave lengths into account and gives some notes on the emissivity of various bodies.—*La Revue Electrique*, Aug. 15.

Arc Lamps.—R. OSTERBURG.—The first part of an illustrated article describing improvements recently made in the mechanism of the suspension of arc lamps.—*Elek. Zeit.*, Aug. 16.

Power.

Feed-Water Heater.—A description of the latest improved form of G. Wilkinson's live-steam feed-water heater, which can be applied to any form of boiler for the purpose of raising the feed water to a temperature approximating that of the steam in the boiler. The apparatus consists of the following parts: A de-aerating chamber fixed at the highest position within the boiler, into which the feed water is delivered; a number of dishes and plates, fixed alternately, over which the feed water gravitates to a receiving chamber. These are built round a vertical hydraulic tube passing through the shell of the boiler. This tube is open at its upper, and closed at its lower, end. A little mercury is poured down the tube to facilitate the transmission of heat to a thermometer which is inserted therein. This thermometer gives the temperature of the feed water at the point where it flows into the water space of the boiler. A tank and dip pipe are fixed below the receiving chamber, and serve to convey the feed water at steam temperature to the bottom of the boiler, near the "blow-off" valve. A small pipe connecting the de-aerating chamber to an air valve

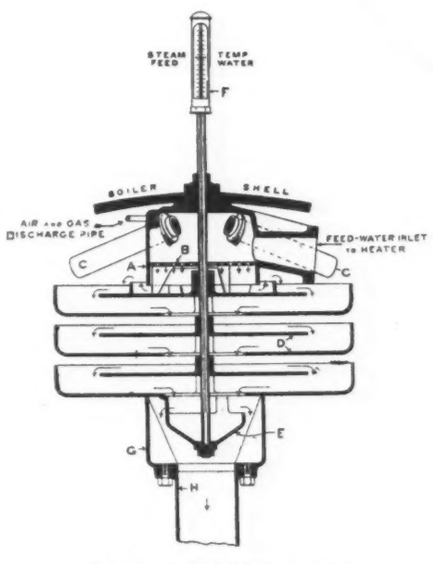


FIG. 2.—FEED-WATER HEATER.

outside the boiler completes the equipment. In Fig. 2 *A* represents the heating and de-aerating box, *B* grid, *C* steam-breathing pipes, *D* final heating plates, *E* testing tank, *F* the thermometer, *G* overflow tank and *H* discharge pipe. The main function of the apparatus is to deliver feed water at the full ebullition temperature at the bottom of the boiler, thereby greatly accelerating circulation and relieving the boiler plates from undue strain. Figures are given on the results of some tests with and without the heater. By the use of the heater a gain was obtained, resulting in increased evaporation per pound of coal, 12.9 per cent, and a saving in coal, making no extra allowance for a continuously clean and efficient boiler, of 11.4 per cent.—Lond. *Elec. Eng'ing*, Aug. 22.

Cable Ways.—J. M. HENDERSON.—An illustrated paper read before the (British) Institution of Mechanical Engineers. The author describes the electric cable ways which are in use at the shipbuilding berths of Palmer's Shipbuilding & Iron Com-

pany at Jarrow-on-Tyne. Steel lattice pillars connected by cross girders form the end structures, and between these, in a longitudinal direction, are run the main cables, the ends of which are attached to electrically driven carriages, capable of transverse motion along the end girders. On these cables self-contained trolleys are suspended containing the lifting gear. The transverse motion of the cable, as well as the longitudinal motion of the trolleys on the cables, are controlled by the operator on the lifting trolley, who also controls the lifting and lowering.—Lond. *Elec. Eng'ing*, Aug. 15.

British Station.—An illustrated description of the new power house of the South Metropolitan Electric Light & Power Company. The new station is located next to the company's old plant. The generating plant at present installed consists of two 1500-kw turbo-generators, but the ultimate capacity of the station is to be 32,000 kw. The arrangement of the plant is simple and compact, and full advantage is taken of the proximity to the river bank for coal and condensing water facilities.—Lond. *Elec. Eng'ing*, Aug. 15.

Steam Power.—W. D. Ennis.—A third article in his serial on efficiency in the burning of fuel under the steam boiler. In the present installment the author discusses the practical modifications affecting the theory of the air supply and necessitated by various commercial fuels.—*Eng'ing Magazine*, August.

Turbines.—J. Dalemont.—A continuation of his long-illustrated serial on the wear and tear of turbines. In the present installment the author discusses several special cases of corrosion.—*L'Eclairage Electrique*, Aug. 24.

Traction.

New York Interborough System.—G. B. Werner.—An analysis of the operating costs and revenues of the Interborough Rapid Transit Company for the year ending June 30, 1906. The various items of the operating expenses are reduced to the car-mile basis. The cost of maintenance of way and structures is 0.996 cents per car-mile; the maintenance of equipment, 1.214; the operation of power plant, 1.965; the operation of cars, 3.800; general expenses, 0.997; total expenses, 8.972 cents per car-mile. The maintenance of way and structure represents 11.10 per cent of the total operating expenses; maintenance of equipment, 13.54 per cent; operation of power plant, 21.90 per cent; operation of cars, 42.35 per cent; general expenses, 11.11 per cent. The total operating expenses are 42.69 per cent of the gross earnings. The figure for the total operating expense of 8.97 cents per car-mile is very low. The operating cost on a number of representative electric roads, elevated and surface, averages about 13 cents per car-mile, the higher figures representing urban lines. The Brooklyn Heights Railroad (elevated and surface) and the New York City Railroad (surface) runs up to 14.8 and 18.4 cents, respectively.—*Eng'ing Magazine*, August.

Electrification of Cable Railway.—An article on the inclined cable railway connecting Lyons with a suburb which has recently been converted from steam power to electrical driving. Continuous current at 500 volts is used, and advantage is taken of the presence of a buffer battery to arrange for voltage control during the starting and acceleration of the trains. The safety appliances are well worked out, and figures given show that the electrification has resulted in a saving of over 50 per cent in the power expenses of the railway.—Lond. *Electrical Eng'ing*, Aug. 22.

Electric Traction.—P. Dawson.—A continuation of his illustrated serial giving remarks on the choice of acceleration and motors.—Lond. *Elec.*, Aug. 16.

Installations, Systems and Appliances.

Oscillations in Direct-Current Networks.—C. Feldmann and J. Herzog.—A mathematical investigation of high-frequency oscillations which may occur in direct-current cables, with replies to criticisms of Hiecke.—*Elek. Zeit.*, Aug. 15.

The Peak Load in Electricity Supply.—An editorial proposes the obtaining of a uniform load curve by using for electrochemical work the excess of power of a station which cannot be sold for other purposes. It is stated that a calcium carbide factory is to be erected close to a British central station to use the surplus power of the latter.—Lond. *Elec.*, Aug. 16 and 23.

Tariff.—A description of a method of charging for electrical energy for which a meter has been patented by a German company. It is essentially a combination of a two-rate meter in conjunction with a maximum demand indicator.—Lond. *Eng'ing*, Aug. 22.

Wires, Wiring and Conduits.

Wiring Rules.—Sets of standardization rules for overhead wiring, cables, etc., of the German Association of Electrical Engineers, with an article by H. Jaeger, G. Klingenberg and F. Schrottke, giving explanations of the rules.—*Elek. Zeit.*, Aug. 15.

Fuse.—An illustrated description of a new spring fuse devised by J. W. Turner. The ends of the fuse when broken are rapidly drawn by springs into sand pockets.—Lond. *Elec. Eng'ing*, Aug. 22.

Electrophysics and Magnetism.

Luminosity and Conductivity of Flames.—F. L. Tufts.—An abstract of a Physical Society paper. In the case of the red lithium line and the yellow sodium line the luminosity of a Bunsen flame varies directly as the electric conductivity imparted to the flame by the salt vapors, whether the variation is produced by varying the rate of supply of air, gas or salt spray to the flame, or by the introduction into the flame of chlorine gas or chloroform vapors. Both the luminosity and the ionization imparted to the Bunsen flame by the salts of lithium and sodium are directly connected with the formation in the flame of the oxides of these metals.—*Phys. Review*, July.

Ether.—Lord Kelvin.—A theoretical paper on the motions of ether produced by the collisions of atoms or molecules containing or not containing electrons.—Lond. *Electrician*, Aug. 16.

Electric Waves.—W. B. Cartmel.—A discussion of experiments of Blake and Fountain on the extra transmission of electric waves, with a reply to recent criticisms of Schaefer.—*Phys. Review*, July.

Electrochemistry and Batteries.

Tantalum Rectifier.—G. Schulze.—An account of experiments on the use of tantalum electrodes in electrolytic rectifiers. They are in some respects superior to aluminum electrodes, since they are formed more rapidly and show valve action in all electrolytes examined. The highest valve action may be obtained in the carbonates of the alkalies, sometimes approaching 1000 volts. In all electrolytes the effectiveness is greatly reduced by concentration. The deleterious effect of breaks is greater in tantalum than in aluminum. The deleterious effect of heat is much lower in tantalum. The relation between thickness of the gaseous layer and voltage resisted is different in tantalum and in aluminum, supposing the layers to have the same dielectric constant in both. There is no satisfactory agreement between the potential gradient near an (ineffective) tantalum cathode and the gradient deduced from sparks between electrodes very close together. Disruptive observations made with mercury in place of the electrolyte give the same results as in the case of aluminum. The valve action is also great in vanadium and niobium, as well as aluminum and magnesium, but occurs in other metals also under favorable conditions.—*Ann. d. Physik.* No. 7; translated in abstract in Lond. *Electrician*, Aug. 16.

Edison Accumulator.—F. Foerster.—A long paper on the nature of the chemical reaction in the Edison accumulator. The active mass of nickel at the end of charging is a mixture of Ni_2O_3 and NiO_2. On drying this oxide changes of the sesquioxide Ni_2O_3 and on discharging $Ni(OH)_2$ is produced.—*Zeitschrift fur Elektrochemie*, July 12; from Lond. *Elec. Eng'ing*, Aug. 22.

Units, Measurements and Instruments.

Carborundum for Rectifying Alternating Currents and as a Wave Detector.—G. W. Pierce.—The first part of an experimental paper on crystal rectifiers for electric currents and electric oscillations. This first part deals with carborundum, which is shown to be unilaterally conducive. With one speci-

men under 10 volts the current in one direction was 100 times the current in the opposite direction. With another specimen platinized on one side the current at 34.5 volts was 527 times as great as the current in the opposite direction under the same voltage. In another case at 30 volts the current in one direction was 4000 times the current in the opposite direction under the same voltage. On account of this unilateral conductivity carborundum may be used for rectifying alternating currents. As the current increases, the efficiency of rectification decreases. A specimen platinized on both sides has a smaller efficiency of rectification, but a much lower resistance than a piece not platinized. Though the efficiency of rectification is

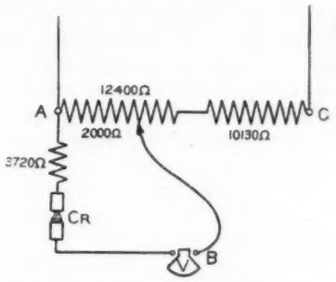


FIG. 3.—ARRANGEMENT OF RESISTANCES.

less with the platinized specimen, the excess of one current over the other for a given voltage is much greater with the platinized specimen on account of its low resistance. Carborundum may be used in this way to adapt an ordinary direct-current measuring instrument to the measurement of alternating currents. The utility of these crystals for this purpose will depend upon their permanence and constancy when submitted to long continued use. For this purpose long runs are at present being made. An alternating voltmeter making use of carborundum as the rectifying substance has stood satisfactory tests for several weeks. The crystal is put in a metallic clamp enclosed in a tube containing oil, and is used with a delicate milliammeter, with a scale of 100 divisions, each division being 3.92 x 10.6 amperes. Shunt and series resistances as shown in Fig. 3 are used. When these resistances are properly chosen the scale of the instrument used as an alternating voltmeter will be nearly uniform over a wide range, or if desired the readings for the small voltages may be spread out instead of being compressed as in the ordinary alternating voltmeters. By dispensing with some of the series resistance, or by changing the shunts, it is possible to give the instrument a multiple scale. Calibration curves for the instrument are shown in Fig. 4. Curve I shows the reading of the direct-current instrument for different alternating voltages, the instru-

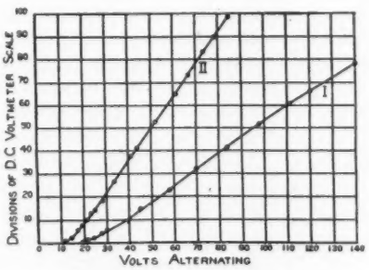


FIG. 4.—CALIBRATION CURVES.

ments being provided with the shunt and series resistances shown in Fig. 3. Curve II is the corresponding calibration curve without the 10,130 ohms series resistance. Both of the curves are nearly straight above 20 volts. When it is desired to measure voltages smaller than those given above, a step-up transformer may be used to raise the voltage of the alternating circuit. On account of the high resistance of the carborundum the factor of transformation may be very great, so that the primary of the transformer may be of such small resistance that its introduction into a circuit will not materially modify the conditions of the circuit. In a telephone line a transformer of this kind might quite accurately replace one of the transformers between the talking and listening circuits of the line. Very feeble currents may be measured in this way, and many experiments on resonance in telephone circuits may be performed. An explanation is given of the adaptability of carborundum for electric wave detectors. Besides carborundum a number of other crystals have the same property.—*Phys. Review*, July.

Alternating-Current Galvanometer.—A. H. TAYLOR.—The instrument discussed in this paper is really a shunt-circuit dynamometer with a laminated iron core. Or, it is an ordinary D'Arsonval having a laminated iron core separately excited by a current drawn from the same source as the alternating current to be detected. Since the moving coil hangs in an alternating field, it must either not be wound on a copper frame, or else the reaction of the frame (due to eddy currents) must be compensated for after the manner of Stroud and Oates, who used this method of controlling the initial equilibrium position of the moving coil. A more satisfactory method of control is the one devised by Terry. Providing that the suspensions are not too heavy, they have in general but little to do with the initial position of the coil when the field current is on, since the induced currents in the coil react upon the field in such a way as to produce a torque whose direction depends on whether the induced current leads or lags with respect to the induced e. m. f. To use the galvanometer as a detector of alternating current, it must be permanently connected to the circuit. If the coil is too stable in the first position, with its plane parallel to the field, it must be shunted with a capacity whose effect may be regulated by a resistance in series with the same; if the coil turns its plane perpendicular to the field, it must be shunted with a resistance. Hence, on any but a very low-resistance external circuit, the control circuit may be regulated very easily so that the coil is not constrained by its own induced currents. Then the current to be detected is applied to the external circuit, and produces its effect as in any galvanometer. This galvanometer is especially useful as a sensitive instrument for the detection of alternating currents in bridge work, and it has the great advantage of being applicable to commercial circuits of ragged wave form and inconstant frequency.—*Phys. Review*, July.

Capacity and Power Factor of Condensers.—F. W. GROVER.—An abstract of a Physical Society paper. In a condenser having absorption, the angle of phase difference between the current and the electromotive force is less than 90 degrees by a small angle θ, the power factor being equal to sin θ. The author describes four methods for simultaneously measuring the capacity and the power factor of a condenser. These methods have been applied for testing a large number of condensers at frequencies between 30 and 1000. For good mica condensers the angles θ may be as small as 0′ 30″ and as large as 4′. Poorer mica condensers, especially if their capacity is small, may give values of θ as large as 30′ or even more. Good condensers, with a paraffined paper for a dielectric, have a value of from 5′ to 20′; in poor telephone condensers, angles as large as 10 degrees have been observed. For all the mica condensers examined the angle θ diminishes slowly as the frequency rises. The same result was observed with all the poorer paper condensers, but with some of the better paper condensers the effect was in the opposite direction. The changes are all greater than in the case of mica condensers. Above 20 degrees the power factor increases with rise of temperature both in mica and in paper condensers, the effect being small for the former and very large for some of the poorer paper condensers. Since the power factor depends primarily on the absorption, the leakage having but a small effect, the value of the power factor gives a relative indication of the magnitude of those effects which depend on absorption, viz., residual charges, change of capacity with the frequency, dependence of the apparent capacity on the time of charge and discharge, etc.—*Phys. Review*, July.

Variations of Standard Resistances.—E. B. ROSA and H. D. BABCOCK.—An abstract of a Physical Society paper. In the

course of an extended investigation on the ratio of the electromagnetic to the electrostatic units carried out at the Bureau of Standards in Washington, it was found that all the resistances employed had a higher value at the same temperature in summer than in winter, the change being a gradual drift upward from early spring to midsummer, followed by a steady drift to the same minimum in the winter. The amplitude of the change was of course small, varying from 15 to 25 parts in 100,000, but far too large to be neglected in precision work. This variation was found to be due to the effect of atmospheric humidity on shellacked coils of manganin wire. The cause of the increase of resistance appears to be the stretching of the wire due to the shellac expanding as it absorbs moisture. On drying out in a dryer atmosphere the shellac and the wire embedded in it contract to their original volume and the resistance fall to its original value. A new form of sealed resistance standards is being developed.—*Phys. Review,* July.

Switchboard Connections of Wattmeters and Watt-Hour Meters for Measuring Power and Energy in Polyphase Circuits.

By Paul MacGahan.

A simplified description of the various methods employed in measuring polyphase power and energy by means of switchboard meters and directions for locating errors in connections will be of use to many who are unfamiliar with the practice of the principal electric companies.

It has been the experience of the writer that approximately 90 per cent of the outside troubles which the manufacturer has to deal with, otherwise known as "kicks," have been traced to

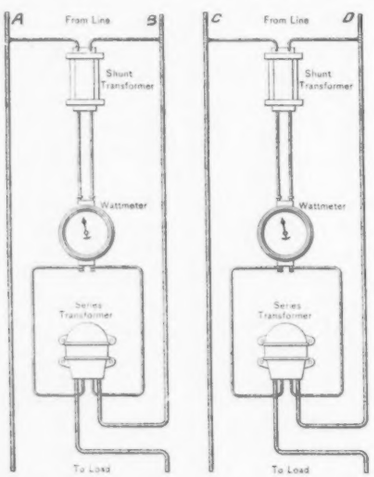


FIG. 1.—CONNECTION FOR MEASURING POWER IN A TWO-PHASE CIRCUIT WITH SINGLE-PHASE METERS.

errors in connections, the watt-hour meters themselves being at fault approximately in only 10 per cent of the cases reported. Therefore, it follows that it would be well, in all cases where the operation is not satisfactory, to look into the connections before blaming the meters or the meter transformers.

Single-phase measurements being familiar to all, will not be dwelt upon further than to say that if the indications are reversed, either the voltage or the current leads should be reversed.

For polyphase work, it is recommended never to use single-phase meters. If one single-phase meter is used, even with a "Y box," the readings are dependent directly on the balancing of the load equally between the phases, any unbalancing producing an error in proportion. It is futile to assume that any polyphase circuit will be balanced. Even when operating only an induction motor or a synchronous motor, it is possible to have a violent unbalancing, due to a voltage unbalancing of the line. A case came to the writer's notice where a single-phase meter on a Y box connection to a three-phase motor circuit actually reversed, due to a reversal of the flow of energy in only one phase of the induction motor, caused by a lower voltage on that phase than on the others.

When two wattmeters are used to measure power in a polyphase circuit, their readings must be added to obtain the true power, and, moreover, on three-phase, a special set of connections must be used involving three series transformers and a voltage transformer having a mid-voltage secondary loop. Such an arrangement will be found much more expensive than a polyphase meter.

The modern polyphase wattmeter consists of two single-phase wattmeters with a common shaft. When properly connected, registration is correct under all conditions of unbalancing or low power factor. It is equally correct on either single-phase, two-phase, three-phase three-wire, three-phase four-wire, or three-phase six-wire. Thus it may always be calibrated on single-phase for use on any polyphase circuit.

The diagrams in the following explanations are schematic only, and do not show the actual appearance of the instruments. In Figs. 8, 9 and 10 are shown several instruments as they actually appear, without any connection to outside circuit, however. From the diagrams and the actual instruments the exact connection is readily determined for an actual meter.

METERING POWER IN TWO-PHASE CIRCUITS WITH TWO SINGLE-PHASE WATTMETERS.

Two wattmeters connected as shown in Fig. 1 may be used to measure the power in a two-phase circuit. In making connections care must be exercised to see that the voltage leads are connected to the proper phases. If it is inconvenient to trace the connections, a voltmeter may be used to insure that the voltage is not taken "across phases." By this test the voltage across *a-b* or across *c-d* should be the normal e. m. f. of the system, and the voltage across *a-c, b-c, a-d* or *b-c* should be zero, if the system is not "inter-connected." If the system under test is interconnected, the voltage across *a-c, a-d* or *b-c* should be 70.7 per cent of the normal voltage.

If either meter shows reverse reading, the voltage leads should be reversed; if the meters read incorrectly and show a uniform reading at all times of the day, the probabilities are that the voltage circuits are interchanged. Under these conditions of connections to the wrong phase, its voltage being displaced 90 degs., the meter would only measure the wattless component of the apparent power.

If a polyphase meter is used to measure the power in a two-phase circuit, the above considerations still hold true, the connections being as shown in diagram Fig. 2.

These methods presuppose that no power is taken from across phases. If, however, there exists between the phases a load that is to be measured, a different arrangement is necessary, as the ordinary two-phase connection would not take account of loads between any two lines not having series transformers. To measure the power properly when load is drawn across phases it is necessary to connect a series transformer in each line, as shown in Fig. 3. To prove that this method is correct, the following case is assumed in which the voltage is 100 volts per phase (therefore, 70.7 volts between adjacent leads) and the series transformers are wound for a primary of 1000 amperes and a secondary of 5 amperes. Assuming that the wattmeter series coils are wound for 10 amperes, it will be seen at once that the proper calibration would be 10 amperes × 100 volts (or 1000 watts) in each phase of the wattmeter, for a single-phase load equalling 1000 amperes × 100 volts × 2, or 200 kilowatts on the meter's dial.

A load of 1000 amperes at 100 volts and 100 per cent power factor, or 100 kilowatts between wires *A-A'* will act upon the wattmeter as follows:

As one series coil is carrying 10 amperes and one voltage coil, 100 volts and the time-phase displacement between the current and the voltage to which the voltage coils are connected is (assuming 100 per cent power factor) zero, the watts will equal 100 × 10 or 1000, which equals 100 kilowatts on the dial. This

result is in accordance with the calibration and is correct. (Note: Under the above conditions one set of series coils is carrying no current.)

A load of 1000 amperes between wires *A-B*, at 70.7 volts, and 100 per cent power factor, or 70.7 kilowatts, will act upon the wattmeter as follows:

Each series coil will carry 5 amperes, which is displaced in phase 45 electrical time-degrees from the voltage impressed upon the voltage coils, which is 100, thus $5 \times 100 \times$ cos. 45 degs. equals 353.5, whence the meter will indicate according to the calibration $\frac{353.5}{1000} \times 200$ equals 70.7 kilowatts, which is correct. Hence, it will be seen that any distribution of the load will be correctly metered by this method.

THREE-WIRE THREE-PHASE CIRCUITS.

Power in the three-wire three-phase system may be correctly measured by means of two single-phase meters connected as shown in Fig. 4.

Assuming a balanced load of 1000 amperes, 100 volts, 100 per cent power factor with 1000/5 series transformers. The total power will be equal to that in three single-phase circuits whose currents are the line currents and whose voltages are the Y voltages of the system, it being noted that at 100 per cent

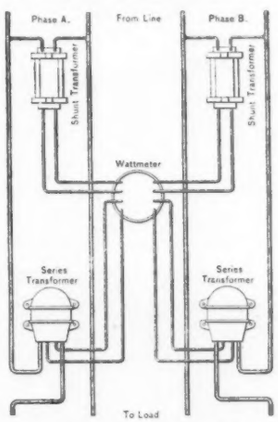


FIG. 2.—CONNECTIONS FOR MEASURING POWER IN A TWO-PHASE CIRCUIT WITH A POLYPHASE WATTMETER.

power factor, the time angle between the line currents and the △ voltages or voltages between the lines is 30 degs. in a three-phase system and that the Y voltages are 57.7. Hence the power is $1000 \times 57.7 \times 3$ equals 173.2 kilowatts.

The meters are calibrated as for single-phase; that is, 5 amperes, 100 volts, 500 watts on the coils equals 1000×100 or 100 kilowatts registered. With 100 per cent power factor, meters A and B will have in their coils 5 amperes $\times$ 100 volts $\times$ cos. 30 degs., equals 433 watts, which will, of course, indicate $\frac{433}{500} \times 100$ kilowatts or 86.6 kilowatts. Hence, the total reading of the two meters will be 173.2 kilowatts.

It will be noted that if the power factor is less than unity the angle of lag must be taken account of in addition to the 30 electrical time-degrees of normal lag between the current and the voltage. Thus, at 50 per cent power factor, the extra angle of lag (that is, the angle of lag between the Y currents and the Y voltages) is 60 time-degrees. Hence the total power is $100 \times 57.7 \times$ cos. 60 degs. $\times 3 = 86.6$.

In the coils of meter A there will be 5 amperes $\times$100 volts $\times$ cos. 90 degs. $= 0$, and it will thus indicate 0. Meter B will have in its coils 5 amperes $\times$ 100 volts $\times$ cos. $-$ 30 degs. $= 43.3$ watts, which will, of course, give a reading on the dial of $\frac{433}{500} \times 100$ or 86.6 kilowatts. Hence, it is seen that in the case of a load at 50 per cent power factor, meter A registers 0, meter B registers the total power, the sum of the two readings being the correct power, as before.

It should be noted that when the power factor becomes less than 50 per cent, meter B registers more than the total power, and meter A registers backward an amount sufficient to make the total power indicated still correct.

It can readily be shown by a specific example that no amount of unbalancing can give any error in the total readings, which will always represent the true power.

It is interesting to note in this connection that on a balanced

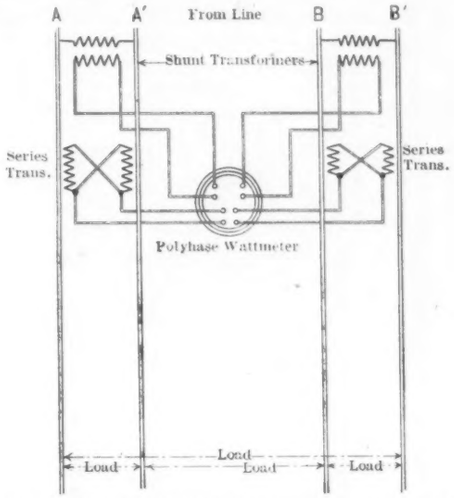


FIG. 3.—CONNECTIONS FOR MEASURING POWER IN AN INTERCONNECTED TWO-PHASE CIRCUIT, BY MEANS OF A POLYPHASE WATTMETER.

load, a comparison of the two wattmeter readings gives an indication of the power factor of the system, as shown in the accompanying table:

Ratio.	Power Factor.	Ratio.	Power Factor.
1.00	100.	.4	80
.9	99.	.3	73
.8	97.5	.2	65
.7	95.5	.1	58
.6	92.	.0	50
.5	86.5		

There have been many ways devised to prevent the ratios of the readings varying with the power factor, among which may be noted:

1.—Connecting the series coils of the wattmeters to two series transformers in parallel, the primaries of the transformers be-

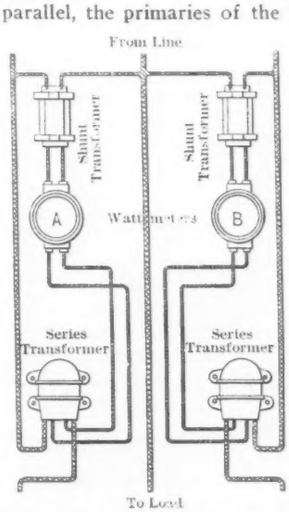


FIG. 4.—CONNECTIONS FOR MEASURING POWER IN A THREE-PHASE CIRCUIT BY MEANS OF TWO SINGLE-PHASE WATTMETERS.

ing in different phases. The phase of the resultant secondary current in the meter will thus be displaced by 30 time-degrees from its normal time-phase position with reference to the voltage, thus preventing the reversal. The voltage coil of one of the wattmeters is connected from one line to the middle point of a voltage transformer connected across two of the lines, thus shifting the phase of the voltage coil by 30 electrical time degrees.

2.—The use of a "Y box" so as to connect the voltage coils from the lines to an artificial neutral point. If one single-phase wattmeter is used for either of the above methods, the readings depend upon the balance of the system, as before explained. If more than one wattmeter is used, two or more readings must be taken, thus increasing the chance of error, in addition to increasing the cost and the inconvenience.

3.—Mechanically connecting the two wattmeter elements and mounting them in the same case, to operate a common dial.

This method, known as the "polyphase wattmeter method," is the only one which has proven thoroughly satisfactory. The

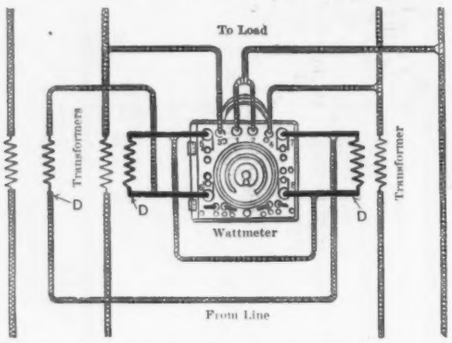


FIG. 6.—POLYPHASE WATTMETER IN THREE-PHASE, FOUR-WIRE CIRCUITS WITH SERIES TRANSFORMERS.

common shaft or other mechanical connection adds the readings of the two wattmeter elements automatically, thus preventing a reverse reading unless the total power actually reverses its sign. The readings of a well-designed polyphase meter are strictly independent of the power factor or the unbalancing of the system, and it will read correctly on either single, two, or three-phase, if properly connected to the circuit. To secure the above results, it is important that the design of the meter be such that one element does not affect the other inductively. Thus the older polyphase meters made with two electromagnets driving a common disk are very much inferior to the designs employing two separate disks or drums on the same shaft.

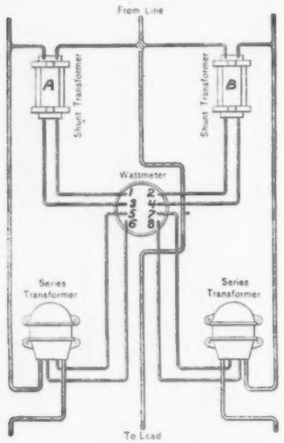


FIG. 5.—THREE-PHASE WATTMETER CONNECTION.

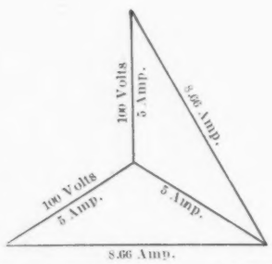


FIG. 7.—VOLTAGE AND CURRENT RELATIONS.

The connections for measuring the power in a three-phase three-wire system by means of a polyphase wattmeter are as shown in Fig. 5.

It is important for the connections to be correctly made. With some makes of meters or of series or voltage transformers it occurs that the leads are not properly brought out, thus necessitating a variation from the diagram of connections furnished. Some manufacturers now mark one primary and one secondary lead with corresponding symbols, indicating similar "polarity." Frequently the leads are threaded through conduits, or they may be hard to trace for other reasons. The following simple test should determine whether the connections have been properly made:

The connections should be tested when the load is on, and the power factor is higher than 50 per cent. First, the voltage at the shunt binding posts 3-4 should be 1.73 times that on 1-3 and 2-4, and the voltage should be zero on 1-2. If voltage 3-4 is equal to 1-3 and 2-4, one of the voltage transformers must be reversed. Second, the series transformer in only the line to which the voltage transformer *B* is connected (not the line common to both voltage transformers) should have both of its leads brought to 7-8, and the series transformer in only line to which voltage transformer *A* is connected should have both of its leads attached to 5-6. Third. One series trans-

FIG. 8.—POLYPHASE INDICATING WATTMETER, SWITCHBOARD TYPE.

former should be disconnected at a time and the meter should in each case read forward, the power factor being over 50 per cent. If it reads backward, reverse the terminals of the series transformer which causes a backward reading.

FOUR-WIRE THREE-PHASE WATTMETER CONNECTIONS.

When a polyphase wattmeter is to be used on a four-wire three-phase circuit, the connections must be such as to take ac-

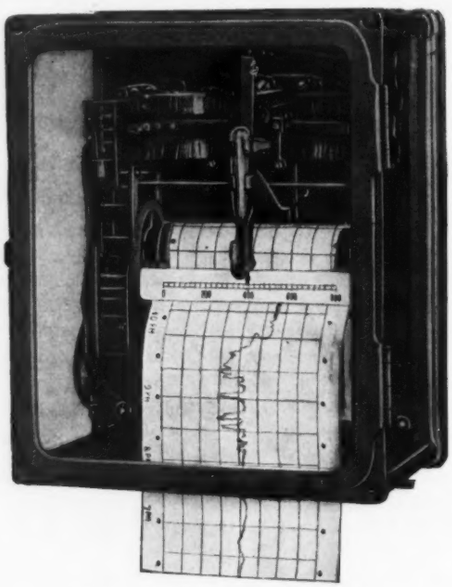


FIG. 9.—RECORDING WATTMETER.

count of power drawn either across phases, or from any phase to the neutral, under all conditions of unbalancing or power factor. This result is obtained by using connections to the voltage coils from two of the lines to the neutral instead of to the third phase as usual in ordinary three-phase circuits, and a third series transformer is connected to take account of the current between the third line and the neutral or "ground." The connections to the extra series transformer are shown in Fig. 6. It is exceedingly important for the connections to be exactly correct, otherwise the meters will not read correctly.

Assume a three-phase, four-wire circuit with 100 volts to the neutral, and 1000/5 ampere series transformers. The standard calibration is such that 100 volts, 5 amperes, and 500 watts

(both sets of coils on single-phase) registers as 200 kilowatts. When there is a load of 1000 amperes in each line, a total load of 1000 × 100 × 3, or 300 kilowatts is obtained. In each series coil the resultant of the two 5-ampere currents in the series transformer secondaries, 120 degs. apart in time-phase, is 8.66, which will be 30 degs. out of time-phase with the voltages (assuming 100 per cent power factor). See Fig. 7. Hence, each electromagnet of the wattmeter will be subjected to 8.66 amperes × 100 volts × cos. 30 degs., or 750 watts. Hence the registration will be (from the calibration given) $\frac{750}{500} \times 200$, or 300 kilowatts, which is correct. It can readily be shown by an example that no amount of unbalancing can affect the accuracy of the reading.

In order to test the connections, there should be a load on and the power factor should be higher than 50 per cent. First, the voltage at the shunt binding posts 3-4 should be 1.73 times that at 1-3 and 2-4, and it should be zero at 1-2. If the voltage 3-4 is equal to 1-3 and 2-4, the terminals of one of the voltage transformers must be reversed. Second, the series transformer, in the same line to which voltage lead 4 is connected, should have both of its leads brought to 7-8, and the series transformer in the line to which the voltage lead 3 is connected should have both of its leads attached to 5-6. Third, all three series transformers should be disconnected by opening one lead of each at points *D*, between the transformer and the point where the secondary wire connects to another transformer (not between the junction point of the transformers and the meter). The meter will then read zero. One series transformer at a time should then be reconnected in succession and the meter in each case should indicate forward. If it indicates in the reverse direction (the power factor being over 50) the leads at the series transformer terminals should be reversed. When all three of the phases thus cause the meter to read forward, the connections are correct.

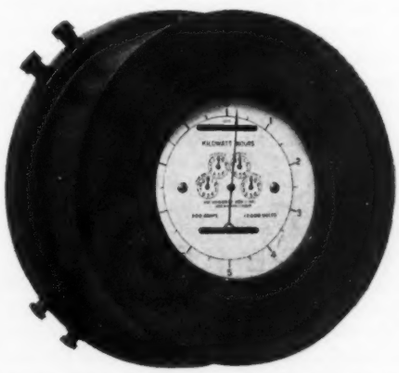


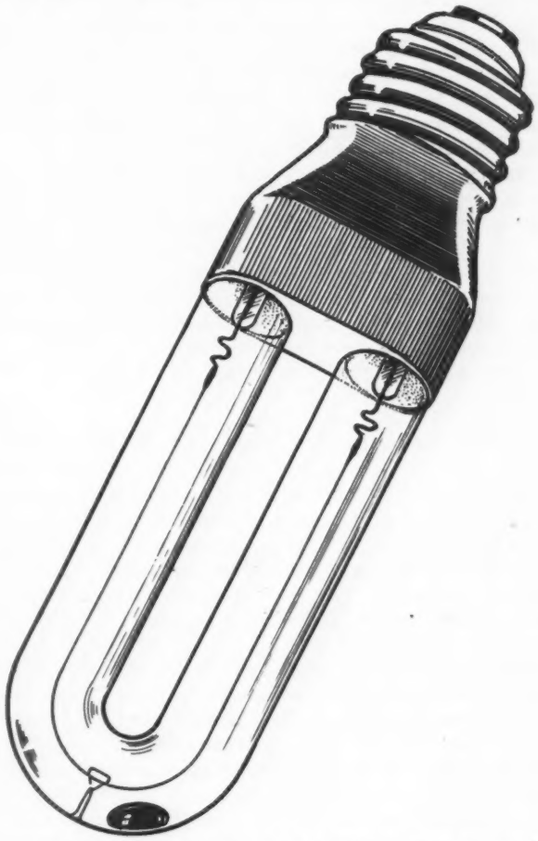
FIG. 10.—POLYPHASE WATT-HOUR METER, SWITCHBOARD TYPE.

The above remarks, although applying to wattmeter connections and power measurements, are directly applicable to the connections used with watt-hour meters for measuring the energy transmitted over polyphase circuits.

New Type of Incandescent Lamp.

Since the introduction of the mercury vapor lamp, and its adoption in commercial work generally, various attempts have been made to combine with it the incandescent lamp in such a manner that the color of the vapor light would be corrected to a certain extent, at the same time retaining its economy. What seems, however, to be a distinct new departure is found in the curious lamp of which a sketch is herewith shown. The lamp is a U-shaped tube, both ends of the tube entering the brass cap or socket and being held there by plaster of paris. The carbon filament is also of the same shape and one end is carried into each tube, with the regular leading-in wire; and the loop is anchored at the bottom. When cold, a small button of mercury is seen at the bottom of the lamp, but after the filament has been burning long enough, the mercury becomes vaporized and there is thus secured a direct combination of the two methods of illumination at the same time, in what is said by the German inventor to be a very effective manner. Data as to economy, life, etc., are, however, not yet forthcoming.

The lamp is 5 ins. over all in length, with a 2-in. brass cap extending well down over the tube. The lamp is almost exactly 1½ ins. in width, and each leg of the U is about ½ in. in diameter. As will be noted there is considerable space between the glass legs. The lamp is tipless. It will be interesting to see whether this type makes its way into practice.



COMBINATION FILAMENT AND MERCURY-VAPOR LAMP.

Lectures on Illumination.

Members of the engineering department of the Holophane Company delivered during the past season no less than 98 lectures on illumination. These illustrated lectures have attracted much interest from electric light and gas companies, for the benefit of whose solicitors and customers they are generally given. The lectures treat of the fundamental principles of illumination broadly, combining primary instruction in the practical engineering of light with non-technical expositions of good and bad practice of the art.

Of the lectures given last season, Mr. Lansingh delivered 21, Mr. Lauritzen 8, and Mr. Marshall 69, the latter speaking in all of the principal cities of the Central and Western States, in a tour which lasted over nine months, during which he traveled over 28,000 miles, and addressed approximately 17,000 people. Each lecture was given under the auspices of the local gas or electric company of the city visited, and was widely advertised in the newspapers by write-ups and display advertising, the latter not infrequently running from one-quarter to a full page and continuing several days previous to Mr. Marshall's arrival. Announcements or special invitations also were sent to technical societies, architects, gas and electrical engineers, merchants, window trimmers and others whom the lighting company deemed interested.

The lectures have been notably successful in focusing popular attention upon the importance of the subject of illumination, and were invariably well attended by people whom it was desirable to interest. The greatest practical result of the lectures, however, lay in the more or less informal after-meetings with the commercial men and solicitors of the several companies, who displayed an eagerness and desire for additional information which was testimony of the deep interest they felt. Not infrequently arrangements were made for a series of private talks with the solicitors, these talks being in the nature of practical lessons in illuminating engineering, continuing several days. On a number of occasions, also, Mr. Marshall was called upon to act in his capacity of consulting illuminating engineer for the lighting company.

This branch of the Holophane Company's activities is a distinct departure in educational work along the lines of illuminating engineering. It is undertaken, not as a source of revenue, but to assist those vitally interested—the lighting companies—in bringing forcibly to the attention of their customers and salesmen the importance and mutual advantage of good illumination. The lecture system will be continued the coming season, and applications from lighting companies interested will receive the attention of the Holophane Company.

The Canadian Electrical Exhibition.

The exhibition held this week in the Drill Hall, at Montreal, is the first of its kind ever held in the Dominion except that given some years ago in Montreal under the auspices of the National Electric Light Association, and reflects great credit upon the men responsible for it, notably Mr. W. McLea Walbank (president of the Exposition Company), Mr. R. S. Kelsch (vice-president), Mr. J. W. Pilcher, of the Canadian General Electric Company (secretary and treasurer); Mr. Henry D. Bayne, of the Canadian Westinghouse Company, and others interested in the enterprise. The Drill Hall is a blaze of light, the interior has been literally transformed by a liberal use of Canadian and American flags, and the decoration scheme of blue and white, coupled with the thousands of electric lamps, makes a picture full of brilliant color. The booths have been attractively arranged and a uniform style is maintained throughout.

The Canadian Westinghouse Company has an especially instructive and well selected exhibit, including meters, motors, controllers, fans, etc. The whole lighting of the Drill Hall was entrusted to this company, and the Westinghouse Nernst lamps are used, which give a soft, mellow light, evenly distributed. One of the chief features of the exhibit is the 1500-hp railway type generator, manufactured for the Montreal Street Railway Company, which will be placed in the new power house at Hochelaga. There are also on view the 4000-hp transformer which will be used on the new development at the Soulanges Canal, and a static sign. The latter has a potential of 45,000 volts, and lights up the letters of the name "Westinghouse" in vivid flashes.

There are a great many exhibits of interest. In contrast to many of the other exhibits that of Allis-Chalmers-Bullock, Limited, is intended more for the engineer and student. The company shows a belted alternator with a direct-connected exciter in operation, two alternators built for driving by water wheel, one unwound and the other partly wound, to show the method of fastening the field poles and windings; an engine-type direct-current generator, which can also be used as an alternating-current generator; a number of polyphase induction motors and single-phase self-starting motors; transformers and other apparatus made at their factory in Montreal. On a small scale they reproduce the electric pump which has been in operation for the past two years on McTavish Street. The capacity is only 360,000 gals. daily, as compared with 5,000,000 gals. daily by the city pump, but the unit shows clearly the method of operation.

The electric fountain, with the multi-colored rays, has elicited a universal chorus of admiration. "The man behind the gun" in this case was an Allis-Chalmers-Bullock, Limited, 5-hp induction motor driving a small Worthington centrifugal pump made by the John McDougall Caledonian Iron Works Company, Limited.

The "process of manufacture" is always interesting. Realizing this, Allis-Chalmers-Bullock, Limited, has a number of girls from its factory and shows a regular winding department, where induction motors are built up from the point where the wire is covered until they are ready to operate. This is not only one of the most interesting features, but also one of the most instructive to many of the visitors to the exhibition.

The exhibit of the Northern Electric & Manufacturing Company attracts attention. The company is showing a complete system of fire and police alarms, and the demonstrations which are made at frequent intervals with the fire-alarm bell cause the horses in the fire station located in the Drill Hall to champ their bits and grow restive.

Another interesting exhibit is that of Messrs. Babcock & Wilcox, whose booth is tastefully decorated, and who have a selection of their water-tube boilers and fittings on view. The manager, Mr. H. Wray Weller, is especially proud of a remarkable steel forging which forms part of the exhibit and which excites the interest and admiration of every man who understands the difficulties to be surmounted in making such a piece of metal.

The Packard Electric Company, of St. Catherines, has one of the largest and most attractive exhibits in charge of Mr. George C. Rough, and in connection with this there is a fine display of Jandus interchangeable arc lamps, gyrofans, etc., and the Jandus automatic regulator for alternating-current series-connected arc lamps.

The Crocker-Wheeler Company is well represented in the Packard space by a 65-kw direct-current generator, crane motors and controllers, motors and a large ventilating fan, and the American Instrument Company shows a line of its instruments in the Packard space.

The National Electric Lamp Association is represented by its Canadian member, the Sunbeam Incandescent Lamp Company, which exhibits all kinds of incandescent lamps and Holophane globes. Mr. E. Irving has charge of this exhibit.

Mr. Fred Thomson, of Montreal, keeps a crowd constantly gathered around his booth, where he exhibits a number of interesting experiments, which mystify the public, such as lighting a large incandescent lamp immersed in a bowl of water by placing the bowl upon a sheet of plate glass that rests upon an induction coil. He also exhibits the DeForest wireless telegraph apparatus.

One of the most popular of the exhibits is that of the Canadian General Electric Company, where, in addition to a representative display of its electrical apparatus, it has a space fitted up as "a modern kitchen." Experienced women are busy cooking and distributing little tid-bits, fudge, coffee, etc., and in another corner a young woman is industriously engaged in ironing shirtwaists with an electric iron and explaining the advantages of it over the old-fashioned fire-heated, quickly cooled, heavy flatiron. This exhibit is sending many visitors home with well defined intentions of installing electrical heating and cooking apparatus in their homes. The other part of the Canadian General Electric Company's exhibit consists of magnetite arcs, flaming arcs and enclosed arcs. A mercury arc rectifier, motors, luminous radiators, meters, exide batteries, its own types of Nernst lamps, electric humidifier ejecting a fine spray of water to keep the air moist, a sewing machine run by a motor, automobile coils, etc., all of them interesting to the general public.

The Canadian Fairbanks Company exhibits Fairbanks gas engines belted to one of its generators and one of its pumps. Fairbanks valves, Pratt & Whitney tools, Yale & Towne hoists, Norton emery grinders, etc.

The Canadian Pneumatic Tool Company shows a full line of Duntley electric drills, blowers, grinders and buffers, electric hoists and a "magnetic old-man," a magnetic device for holding

a drill in place, which work has heretofore been done by an old man.

The Vulcan Electric Heating Company, of Chicago, has its soldering and branding irons displayed in the booths of the Sayer Electric Company, R. E. T. Pringle Company and the Montreal Electric Light & Power Company. The irons are shown in actual operation.

The Pringle Company also exhibits D. & W. fuses, boxes and Deltabeston wire, the Hubbard specialties, the Prometheus heating apparatus, the Edison specialties, Moloney transformers, Century Electric Company motors, Adams-Bagnall arc lamps, Beck flaming arcs, and a full line of the Pringle and Ever-Ready specialties.

The Robb Engineering Company shows a 50-kw direct-connected engine and generator and a 25-hp vertical engine.

The Montreal Light, Heat & Power Company occupies a large space in which it exhibits electrically driven coffee grinders, washing machines, meat choppers, heating devices, an electrically-driven vacuum pump and carpet cleaner, Benjamin clusters, D'Olier reflectors, and the Marsh Brothers electric advertising signs of all kinds, many of which are fitted with Hylo Skedoodle lamps. In this space the Shelton vibrator is exhibited and visitors are given a few moments treatment gratis, which serves to keep an interested audience gathered.

Munderloh & Company exhibit Helios arc lamps, Whitney instruments, Gladstone Lalande batteries, Shedrick irons and a line of Munderloh electric fixtures.

A. Roy MacDonald exhibits mica in various forms, including a tube 10 ft. long, 2 ft. in diameter, made of 1½-in. material built up in overlapping sections and consisting of nearly 5,000,000 pieces of (4-in. sq.) mica. It is made for the C. P. R. Company.

The Locke Insulator Company shows a very attractive and interesting line of insulators of all sizes, bus-bars, overhead line material, etc.

American manufacturers are well represented in the John Forman space. This exhibit includes Chase-Shawmut cut-outs and fuses, Trumbull service boxes and combination switches and cut-outs, Alphaduct, the Sangamo meters, American Electric Company heating devices, flatirons and soldering irons; Partrick, Carter & Wilkins annunciators, American transformers, Lima insulators, Gordon batteries, Clayton & Lambert torches and fire pots, Connecticut telephones and switchboards, Crofton storage batteries, Connecticut and Heinz spark coils, Stay-rite spark plugs, etc.

The Montreal Steel Works show a street car equipped with their own make of trucks and Westinghouse motors fitted with the unit switch system of multiple train control.

J. A. Dawson & Company exhibit the Consolidated Car Heating Company appliances; E. W. Bliss gears, pinions and pressing machines; Crouse-Hinds Company headlights; Albert & J. M. Anderson trolley bases; Lord Electric Company and Forest City bonds; Vought-Berger and Stombaugh guy anchors; Keough cord grips; MacAllen Company overhead material; Sterling varnish; Couch telephones; Delaware Hard Fiber Company products; Duby brush holders; Duncan rosettes, sockets, lamp guards, etc., and the patented J. A. Dawson Company controllers made with asbestos board parts. Among the other exhibitors are Aluminum Company of America, aluminum cables and joints; American Conduit Company, conduit construction; Bell Telephone Company of Canada, telephone exchange; Canadian Buffalo Forge Company, electric blowers, etc.; Canada Electric Company, electric and gas fixtures; Canadian Rand Company, Limited, motor-driven air compressor; Dominion Electric Manufacturing Company, Limited, electrical specialties, conduit fittings, switches, switchboards, fixtures; Dossert & Company, solderless connectors and terminals for wires and cables; Economical Electric Lamp Company, turn-down lamps; Fibre Conduit Company, fibre conduit; G. M. Gest, conduit construction; Garth Company, fixtures and fittings; Laurie & Lamp, models of Beliss & Morcom engines for direct connection; Linde-British Refrigeration Company, Limited, motor-driven refrigerating machine; Marconi Wireless Telegraph Company, sending station and in another part of the hall a receiving station; Martel-Stewart Company, Limited, electric signs; Phillips (Eugene F.) Electrical Works, Limited, wires and cables; Sayer Electrical Company, electrical supplies and novelties; Stratton Rotating Engine Company, rotary engine connected to dynamo; Wire & Cable Company, electrical wires and cables.

One of the features of the exhibition is the large sign with the dancing skeleton and Jupiter outlined in white and red incandescent lamps operated by a Dull flasher.

Tuesday night was press night, and there was a special car at the Windsor Hotel at 8 o'clock to convey the members of the fourth estate to the Drill Hall. While the numbers were sparse when the car left the Windsor, a number of the representatives of the city press were at the hall during the evening and were shown the various exhibits by Mr. W. McLea Walbank, the president, and Mr. Kelsch, the vice-president, of the Exhibition Company, ably assisted by Mr. H. D. Bayne, the Montreal manager of the Canadian Westinghouse Company. Later the party were entertained at an informal supper, the piece de resistance being a turkey cooked by electricity and done to a turn, which was announced by Mr. J. W. Pilcher, of the General Electric Company, to be "the first time this bird had been cooked by electricity in the Dominion." A number of speeches were made and an enjoyable evening spent by the various men present. The ELECTRICAL WORLD had the distinction of being the one electrical paper represented at this function.

The booth of the ELECTRICAL WORLD is the first booth on the left hand side, near the entrance, and our friends are invited to make it their headquarters during their visit to the exposition and convention.

Commutator Truing Device.

The accompanying illustration represents a commutator truing device which is being placed upon the market by The Patterson Tool & Supply Company, Dayton, Ohio. The picture shows it to be a simple and substantial device, and it is stated to be very effective in trimming down uneven commutator surfaces,

DEVICE FOR TRUING COMMUTATORS.

which constitute a source of much trouble with dynamos, through sparking, etc. The machine is especially adapted to use on large direct-connected generators. A few of its dimensions are given herewith: Size of base, 7 ins. x 12 ins. x 1 in. thick; diameter of split column, 5 ins.; diameter of swivel stem, 3¾ ins.; length of same, 7 ins.; distance from floor to cross feed handle when down, 7¾ ins.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.—The volume of business was satisfactory, exceeding, in many sections, the activity of last year. The outlook for fall is bright, there being a demand for goods at leading jobbing markets as a result of more favorable crop conditions, which are reported, especially from Northwestern and Southwestern centers. Collections show improvement in different localities, but on the whole they are still slow. Cotton reports range from good on the Atlantic Coast to poor in Texas, the latter because of drought. Foreign commerce at the port of New York for the week showed gains of $2,564,654 in imports and $245,789 in exports. In some of the leading industries the conditions were irregular. Cotton goods manufacturing is active and the stocks are all sold ahead. Iron and steel mills are actively engaged in filling old orders, but report new business light with easier prices. A reduction of 4 cents per pound in "official" copper prices did not cause much new buying. Producers proclaimed that the price at which large sales would be made was 18 cents for Lake, but the market went a good bit below that and the quoted range for spot lake Friday was 17¼ to 17¾ cents as quoted by the Metal Exchange, and the American Metal Company quoted lake at 17½ to 18 cents, but "weak" at that. The closing quotations were 17½ cents for lake; 17¼ cents for electrolytic, and 17⅛ cents for casting copper. Failure returns show some effect of the money stress, but the total for August is, next to August, 1906, the smallest recorded in that month since 1893. The number of commercial failures in the United States in August this year was 850 and the amount of defaulted indebtedness $15,197,749. In the corresponding month last year the corresponding figures were 788 and $8,821,154. The increase in amount of liabilities occurred in the class embracing manufacturing insolvencies, where 217 failures for $11,047,249, compared with 194 failures last year, when the amount of indebtedness was $3,089,172. Trading failures were 621 in number and $3,740,828 in amount, against 573 failures last year when the amount involved was $3,552,039. Distinct improvement occurred in the third class, which embraces brokerage, insurance, real estate and similar concerns, there being only 12 failures, for $409,672, against 21 last year, when the amount involved was $2,179,943. There were only three failures of banks, trust companies and other fiduciary institutions with debts of $2,662,696, which compares with eight similar failures last year, when the amount involved was $7,619,768. *Bradstreet's* reports 130 failures during the week ending Sept. 5, against 167 in the week previous and 121 in the corresponding week last year.

THE COPPER SITUATION.—In their monthly circular, D. Houston & Co. say: "The United States production of copper for the year 1906, as per government figures, was 906,591,947 lbs., and on the basis of present quotations of 18 cents this product could be purchased for $65,727,916 less than at the market price of 25¼ a few months ago. The difference in copper values as above noted leaves an immense amount of capital available for other purposes. The price of electrolytic copper has been reduced to 18 cents by leading producers, and it is to be hoped that the widely irregular features which have characterized market quotations lately may gradually disappear along with the unsettling effect they create. Moderate sales are reported. The market has passed through a protracted period of dullness, and values have consequently been adjusted to a basis more in harmony with existing conditions. The situation is waiting for demand to become a stimulating factor, and while recent buying has not measured up to anything like the normal level, nevertheless, the consumption of copper is bound to start up again eventually on a heavy scale. Meanwhile when conditions are quiet and trading slack urgent sellers have to accept the best they can get, but the low prices on occasional sales do not represent the market for the bulk of supplies. It would take much time for a strong and persistent demand to absorb the floating copper seeking a market, and with that out of the way the tone would show immediate improvement. Many important enterprises are held up until the money market becomes easier, and included in these are a number of electrical projects. No matter what vicissitudes the market for copper may pass through there is one thing that can be safely predicted, it will not remain permanently dull."

RAILWAY TURBO-GENERATOR.—Following the tests recently made on the 1000-kw Allis-Chalmers turbo-alternator now in operation for some months past at the power house of the Kokomo, Marion & Western Traction Company, Kokomo, Ind., this company has placed an order for a duplicate unit comprising a 1000-kw turbine driving a 1000-kw alternator, with turbo jet condensing system complete. The unit is wound for 50 cycles, two-phase, 2300 volts. This unit, like the one already in service, will operate normally with steam pressure of 140 lbs. per sq. in. gauge pressure at the turbine throttle, dry saturated, and a vacuum of 28 ins. of mercury, referred to a 30-in. barometer at the exhaust nozzle. The unit is calculated to carry an overload of 50 per cent when operated under the above steam conditions and at 100 per cent power factor. In the test of the first unit referred to above, the entire load placed upon the machine aggregated only a little over half its normal capacity or approximately 554 kilowatts on the average. Not only did the machines meet the guaranteed consumption and other conditions of the test satisfactorily, but lowered the steam consumption guarantee at one-half load by 2.1 lbs. The test was conducted by Mr. Paul Diserens, of Purdue University, working in consultation with Mr. Phil H. Palmer, superintendent, who represented the traction company's interest, and by Mr. F. C. Purcell, of the Allis-Chalmers Company, Milwaukee. The second unit just ordered will be placed beside the first one in the power house at Kokomo, and will furnish power for lighting and railway service.

DOUGLAS & COMPANY, of Cedar Rapids, Iowa, are large manufacturers of corn products, including corn oil, cake, germ oil, meal, gluten feed and starch for laundry, domestic and manufacturing purposes. The company's plant has been provided with the best equipment obtainable and is operated throughout by means of electric motors, group and individual, drive. The latest addition to the equipment of the Douglas Mills comprises approximately 650 horse-power in Allis-Chalmers induction motors, some of which are of the vertical type especially adapted to the operation of corn product mills. These machines are to operate at standard speeds for driving individual and grouped machines, according to the character of the work.

LARGE ORDER FROM UTAH.—Another silent testimony of the confidence remaining in the country's continued prosperity is the large order for railway equipment just contracted for with the General Electric Company by the Utah Light & Railway Company, of Salt Lake City. The Utah Company is planning large extensions to its present 90 miles of track and will install 50 new cars. The contract calls for 50 complete quadruple equipments consisting of 200 GE-80 40-hp motors with K—28 controllers. In addition the company has ordered 74 GE-80 motors, with extra controllers, circuit breakers, rheostats, etc., for the re-equipment of old cars.

DODGE & DAY, engineers and constructors, of Philadelphia, have submitted a betterment report covering the entire factory of Fayette R. Plumb, Inc., of Frankford, Pa., and are now engaged in making extensive alterations to the forge shops. When this work is finished other departments will be taken up, and ultimately the entire plant will be remodelled.

PRICES FOR VENEZUELA.—We are in receipt of a letter from Messrs. Angarita & Co., Empresarios Luz Electrico, San Crestobal, Venezuela, S. A., stating that they would like to receive from American manufacturers catalogues and price lists of electrical machinery.

THE UTAH COPPER COMPANY has installed in the Garfield plant, at Garfield, Utah, two cranes built by the Northern Engineering Works, Detroit, Mich. One is of 15 tons capacity, three-motor electric type, and the other of six tons capacity hand type.

MINNEAPOLIS TROLLEY POWER.—The Twin City Rapid Transit Company, Minneapolis, operates two power stations, one a hydro-electric plant with an output of 10,000 hp, and operated in parallel with it in a station approximately 1000 ft. distant, a steam-driven electrical generating plant of 35,000 hp normal rated capacity. These two plants furnish electrical energy to ten electric sub-stations in St. Paul, Minneapolis and adjacent towns, the maximum transmission distance being 25 miles, over which alternating current, three-phase, is carried at 13,200 volts, to be converted at the sub-stations into 600 volts direct current. The steam-driven power plant, located on the east bank of the Mississippi River, stands just below the flour mills in the center of the city, in a brick building 155 ft. x 225 ft., and 93 ft. high. The engine room, 67 ft. wide and extending through the length of the building, contains, among other units, four reciprocating engines direct connected to engine type generators. These machines, which comprised the original installation, are Allis-Chalmers vertical cross compound condensing engines 46" and 94" by 60" stroke. They have a normal capacity of 5000 ihp hour, steam at 175 lbs. gauge pressure and 75 deg. F. superheat and engines exhausting into 26" vacuum. The engines, which operate at a speed of 74¼ r. p. m., are equipped with Reynolds Corliss valve gear having an automatic weighted governor operating with the high and low pressure sides. The steam supply and exhaust valves are operated by separate eccentric; the speed control is operated by a motor controlled from the switchboards. Each of these engines occupies a floor space of 17' x 36' and is approximately 36' in height. One of the four engines, the last to be installed, is equipped with an Allis-Chalmers barometric condenser with the condenser chamber attached to the engine cylinder. This condenser has two barometric columns, one 16" in diameter for the removal of both air and water and one 20" for an overflow. Cooling water is supplied by a 20" centrifugal pump. Aside from its city lines a portion of the Twin City Rapid Transit Company's output is utilized for the operation of the double track electric line to Excelsior on the southern shore of Lake Minnetonka, 19 miles west of Minneapolis.

THE STANDARD ROLLER BEARING COMPANY, of Philadelphia, Pa., has recently made many large additions to its plant, which is claimed to be now the largest works of its kind in the world. The buildings extend over one-half mile of ground from end to end, with a floor space of over 500,000 square feet. The concern now employs over 1500 men. The business has grown to such proportions as to necessitate the establishing of a thoroughly organized department of publicity. The new department will be conducted by Mr. C. Dickens Sternfels, who has been identified in a similar capacity with the Arthur Koppel Company, Pittsburg, Pa., for the past three years. Mr. Sternfels assumes charge of the Standard Roller Bearing Company's publicity department on Sept. 16, and will be located at Philadelphia.

AMERICAN CONCRETE POLE COMPANY.—The American Concrete Pole Company, of Richmond, Ind., has taken over the patents of William M. Bailey for the manufacture of concrete poles at its works, and also accord the right to construct to other companies, on a royalty basis, or sell the right for a certain territory. The officers and directors of the company are as follows: A. C. Lindemuth, Richmond, Ind., president; W. M. Bailey, Richmond, Ind., vice-president and general manager; L. E. Browne, Richmond, Ind., secretary and treasurer; James S. Brailey, Jr., Toledo, Ohio; Col. W. P. Orr., Piqua, Ohio; L. M. Flesh, Piqua, Ohio; S. K. Statler, Piqua, Ohio; J. L. Boyer, Piqua, Ohio; John M. Lontz, Richmond, Ind.; Edwin H. Cates, Richmond, Ind.; Perry J. Freeman, Richmond, Ind.

CONTRACTS FOR ELECTRIFICATION OF SOUTHERN PACIFIC LINES IN OAKLAND, CAL.—Contracts were let last week at the New York offices of the Southern Pacific Railroad Company for the electrical equipment of its electrical line in Oakland, Cal., and vicinity. Eighty motor cars will be equipped each week with four 125-hp motors, the contract for which has been awarded to the General Electric Company. The power station will be equipped with two 5000-kw 25-cycle, 13,200 volt, three-phase units, the contract for which has been awarded the Westinghouse Machine Company. Parker boilers have been ordered with Worthington condensers and auxiliaries.

ELECTRICAL SUPPLIES.—Manufacturers of electrical supplies, plant fittings and measuring instruments are invited to send their latest catalogues to the Comptroller of Government Stores, Colombo, Ceylon, for the use of the Government.

Financial Intelligence.

THE WEEK IN WALL STREET.—The stock market showed a continued disposition to take a more favorable view of the financial and speculative situation. There was no increase in public participation in the market, but for the first time in many weeks London was a buyer of American securities. The easing of money rates was the most important factor bearing upon the action of the stock market, and more or less attention continues to be given to the prospect for the success of the New York City $40,000,000 4½ per cent bond issue. There was some renewal of bearish activity in certain securities, but the declines were moderate and no large amount of stocks seemed to be forced out. Later on the underlying strength was exhibited in face of the announcement of the failure of a large stock and grain house, and the passing of the dividend upon Interborough-Metropolitan preferred. The reduction of copper prices by the leading producers to 18 cents failed to have an unfavorable effect on Amalgamated Copper. At the latter end of the week the market was very strong. Electric and traction stocks were comparatively steady on moderate trading, and all closed the week at slightly advanced quotations. Metropolitan Street Railway, which last week suffered a heavy slump, rose to 44, the opening price being 37. The curb market experienced a slow recovery during the week, following the lead of the Stock Exchange list. But little public interest developed, and speculative trading was trifling. The closing stock quotations of Sept. 10 are given below.

NEW YORK.

	Sept. 3	Sept. 10		Sept. 3	Sept. 10
Allis-Chalmers Co.	6⅞	6	General Electric 128		127
Allis-Chalmers Co. pfd..	19⅞	16	Hudson River Tel.....	—	—
Am. Dist. Tel.....	—	20	Interborough Met. com.	10⅜	8⅝
American Locomotive..	54	53	Interborough Met. pfd..	31	25
Amer. Locomotive pfd.	101	102	Mackay Cos.	61¼	64
American Tel. & Cable.	80	75	Mackay Cos. Pfd.....	63	64
American Tel. & Tel..	—	106	Marconi Tel.	—	—
Brooklyn Rapid Transit.	49	46¾	Metropolitan St. Ry....	40	37
Electric Boat	33	33	N. Y. & N. J. Tel.....	—	100
Electric Boat pfd.....	80	80	Western Union Tel....	76½	76
Electric Vehicle	—	—	Westinghouse com 130		133
Electric Vehicle pfd....	—	—	Westinghouse pfd.	—	165*

BOSTON.

	Sept. 3	Sept. 10		Sept. 3	Sept. 10
American Tel. & Tel...107¾		106	Mass. Elec. Ry. pfd.....	52	50
Cumberland Telephone..	—	102	Mexican Telephone.....	—	—
Edison Elec. Illum....205		205	New England Telep.....	—	—
General Electric 129		127⅞	Western Tel. & Tel....	—	5½
Mass Elec. Ry.....	13¼	13	West. Tel. & Tel. pfd..	—	—

PHILADELPHIA.

	Sept. 3	Sept. 10		Sept. 3	Sept. 10
American Railways....	47	46½	Phila. Electric	7⅞	7¾
Elec. Co. of America...	9	9	Phila. Rapid Transit...	15½	19¾
Elec. Storage Battery...	47½	45	Phila. Traction	—	90¼
Elec. Stor. Battery pfd.	—	—			

CHICAGO.

	Sept. 3	Sept. 10		Sept. 3	Sept. 10
Chicago City Ry.....150		150	National Carbon	—	—
Chicago Edison 130		—	National Carbon prd...	—	—
Chicago Subway	20¼	—	Union Traction	—	—
Chicago Tel. Co.....108		—	Union Traction pfd....	—	—
Metropolitan Elec. com.	21½	22			

*Asked.

DIVIDENDS.—The trustees of the Massachusetts Lighting Companies have declared a quarterly dividend of 1½ per cent, payable Oct. 15 to stock of record Oct. 1. This places the shares on a 6 per cent basis, which compares with 4 per cent paid in 1904-5 and 5 per cent since January, 1906. Directors of Safety Car Heating & Lighting Company have declared the regular quarterly dividend of 2 per cent, payable Oct. 1. General Electric Company has declared a dividend of $2 per share, payable Oct. 15. The J. G. White Company, Inc., has declared its eighteenth quarterly dividend of 1½ per cent on the preferred stock, payable Oct. 1.

CHICAGO TELEPHONE.—General Counsel Payne, of the Chicago Telephone Company, says: "The American Bell Company has paid for every dollar's worth of stock it holds. The Chicago Telephone Company has paid the Bell 4½ per cent royalty and this is the only return made to the parent company for its rights. We paid 10 per cent dividends and earned surplus, although our rates are reduced 15 to 25 per cent. Experts say we cannot earn 7 per cent under the proposed ordinance, and we estimate less than 6 per cent. We do not refuse long-distance interchange with any concern having standard equipment."

GENERAL NEWS

Construction News.

COLUMBIANA, ALA.—T. Gordon, of Columbiana, is interested in the establishment of an electric light and water works plant in this town, and also an electric railway between Montevallo and Columbiana.

DOTHAN, ALA.—A. J. Smith, who is organizing a company to construct an electric power plant in Dothan, writes that about $150,000 will be expended. No engineer has yet been selected. The plant will be located about 17 miles from Dothan and will be run by water power.

FLORENCE, ALA.—Improvements are being made to the plant of the Cherry Cotton Mills in this place. The old machinery is being replaced by modern machinery, and electricity is to be substituted for steam power.

HARTSELLE, ALA.—It is reported that local electricians are making estimates on the establishment of an electric light plant in this place.

FORT SMITH, ARK.—Owing to the rapid increase in business the Fort Smith Light & Traction Company is making arrangements to increase the capacity of its plant. New boilers, dynamos and other machinery will be installed. J. Walter Gillette is general manager.

HOT SPRINGS, ARK.—According to an announcement just made a new electric power plant and system to cost more than $135,000 is to be commenced within sixty days by Atwood Benton. Mr. Benton states that the price of electricity will be reduced from 12 to 7 cents per kilowatt hour. A franchise compelling the plant to be in operation by April next and fixing the prices as stated has been granted by the City Council.

OZARK, ARK.—An electric light company has been organized at this place with A. Bueg'ar as president.

ALAMEDA, CAL.—The Southern Pacific Railroad Company has applied to the City Council for an electric franchise covering not only the present broad-gauge and narrow-gauge roads but several branch lines, along the streets as yet untouched by railroads. The application is for an overhead electric railway system for 50 years.

BAKERSFIELD, CAL.—Work has commenced on the construction of a large telephone system, which will practically connect all points in the reserve in Kern County Mountains.

EUREKA, CAL.—Application has been made to the City Council by E. C. Sharp for a franchise to erect and maintain a telephone and telegraph system for a term of 50 years, bids for which will be received by the city clerk until Sept. 24.

FRESNO, CAL.—The board of directors of the Fresno Home Light & Power Company will soon meet and organize. An application for a franchise to erect and operate an electric light and power plant has been prepared and will be presented to the Board of City Trustees in a short time. Plans are now being made for the plant, work on which will begin as soon as the franchise is granted. H. H. Hart, of San Francisco, will be president of the company, and Charles McCardle, secretary.

KENNETT, CAL.—The two furnaces now being added to the copper smelter near this point will have a greater capacity than the three now in operation. A large addition will be built to the power house and the capacity of the plant largely increased. The power house contains three blowers of 15,000 cubic feet capacity, driven by three electric motors of 200-hp each, and two 100-hp motor generators. To these will be added four blowers driven by four electric motors of 250-hp each. The engine operating the converter blower will be driven by a 750-hp motor.

LOS ANGELES, CAL.—A trust deed for $20,000,000 has been executed by the Los Angeles-Pacific Railway Company in favor of the Southern Trust Company, of this city, to secure the payment of a bond issue of that amount. The new bond issue has been ordered for retiring or refunding the old bonds, and to provide funds for the extensive improvements which are to be made to the system. After retiring the old bonds the company will have about $8,000,000 to spend in improvements.

MARTINEZ, CAL.—Z. A. W. Maltby is planning to construct an electric railway from Antioch to Oakland.

NAPA, CAL.—The Snow Mountain Power Company will enter the local electric field and also that of Vallejo and Oakland in addition to supplying Marin, Sonoma, Mendocino, Glenn and Colusa counties. Dr. G. F. Conners, of Calistoga, secretary of the St. Helena Gas & Electric Company, announces that by Dec. 1 the lines of the company would be strung through the entire Napa Valley.

SACRAMENTO, CAL.—The Vallejo & Northern Railway, which is building an electric railway from this city to Vallejo, passing through Woodland and Winters, has procured a franchise to run on Second Street, and also has secured a franchise in Winters.

SACRAMENTO, CAL.—Announcement has been made that the Northern Electric Railway Company will build an electric railway to Woodland, and also along the towns on the west side of the Sacramento Valley. The company will soon ask the Trustees of Woodland for a franchise over certain streets in the city. It is understood that Colusa, Willows, Arbuckle and Winters will be reached by the new line.

ST. HELENA, CAL.—The Snow Mountain Water & Power Company has applied for a franchise in Calistoga, and, if granted, will extend the lines of the St. Helena Gas & Electric Company to that place. Surveys are now being made for locating the line between Napa and St. Helena. The electrical power will be distributed by the St. Helena Gas & Electric Company, which will be reorganized and reincorporated for that purpose. The plant will be taken over by the new company, and the power house now in use will be used as a sub-station. Transformers will be installed in the present station at a cost of about $5,000. The Snow Mountain Company is erecting a power plant on the Eel River in Mendocino County. The main line has been built to Ukiah, and from there a branch line will be built to Lakeport. The main line will traverse Mendocino and Sonoma counties, with Oakland as its objective point. The company has secured many contracts to furnish electricity to operate pumping plants to secure water for irrigation. Dr. G. F. Conners, of Calistoga, is secretary.

SAN DIEGO, CAL.—Plans are being made to electrify the Corando Railroad (steam line) between the ferry and Tent City. William Clayton, vice-president and managing director of the John D. Spreckles interests has charge of the work.

SAN FRANCISCO, CAL.—The Board of Supervisors on Aug. 26 awarded the contract for furnishing light to the municipality to the San Francisco Gas & Electric Company. The appropriation is $275,000.

SANTA ROSA, CAL.—The Pacific Gas & Electric Company has awarded a contract to the Globe Construction Company to erect a sub-station on First Street for $2,175.

TURLOCK, CAL.—C. H. Weed, promoter of the electric and water systems, states that actual work on the construction of the electric light plant will commence at once. The Board of Supervisors has ordered a franchise to be granted to the Turlock Electric & Water Company giving it the privilege to erect poles and wires for furnishing electricity for lighting and power in and about Turlock. It is understood that options have been taken on several blocks of land, as a site for the plant.

DENVER, COL.—Final surveys of the Interurban Construction Company's electric line from Denver to Greeley will soon be started, preparatory to beginning work on actual construction of the road. Rights of way and franchises have been secured by the company in Denver, Adams and Weld counties. The system will cost about $1,500,000 to build and equip. It is the purpose of the company to have the railway completed and in operation by next spring.

DENVER, COL.—It is announced that the main plant of the Northern Colorado Power Company at Lafayette is almost completed, and that a test of the transmission lines over the lines of the entire northern district will soon be made. The plant has a capacity of 12,600 horse-power, and sub-stations have been constructed at Longmont, Boulder, Fort Collins, Greeley, Berthoud and Loveland, and another sub-station is now being built at Niwot. The company will furnish electricity to all of these towns and also to the Fort Collins Tramway Company and to the Denver & Interurban Railway, which the Colorado & Southern Railway is constructing from Denver to the northern part of the state. A sub-station will be erected in Denver to furnish electricity for this road. The equipment is now being installed in the sub-station for the Denver & Interurban, which consists of two 1000-kw, single-phase, turbo-generator sets. Westinghouse, Church, Kerr & Company have the contracts for construction of the plant.

GLENWOOD SPRINGS, COL.—The Central Colorado Power Company is planning the construction of a tunnel 12 miles long at the Shoshone plant near Glenwood Springs. Two miles of the tunnel will be constructed first and will generate 10,000 horse-power, but ultimately an additional ten miles will be built, which when completed will treble the capacity of the plant. There are now three plants under way, and it is understood that additional plants are being considered by the company.

HARTFORD, CONN.—Westinghouse, Church, Kerr & Company have secured the contract to erect an addition to the boiler house extension of the power plant of the Hartford Electric Light Company at Dutch Point.

NEW LONDON, CONN.—Bids will be received until Sept. 30 by Major Harry Taylor, Corps Engineers, U. S. A., New London, for furnishing 40 or more 25-kw electric generating sets, each consisting of a gasoline-driven, multiple-cylinder, vertical engine, directly connected to a direct-current generator.

NORWICH, CONN.—The New England Engineering Company, of New London, has been awarded the contract for the installation of the high-tension transmission line, 22,000 volts, from Scotland station on the Shetucket River to the present municipal plant in this city, for $25,000.

THOMPSONVILLE, CONN.—The electric lighting system is now being operated by electricity furnished from the power plant of the Northern Connecticut Light & Power Company at Windsor Locks. Work has commenced on dismantling of the Enfield electric light station. The large engine, dynamos and boilers will be transferred to the Windsor Locks

station, which give that station three engines besides a water wheel to operate the plant. E. H. Farr, superintendent of the Enfield Electric Company, will be retained as manager of the local supply company.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Sept. 17, to furnish at the navy yards and naval stations the following supplies: New York, N. Y., schedule 270—electrical supplies, cut-outs, fuse wire, switches, Portland and linoleum cement, electric drills, copper wire, etc.; schedule 280—steel conduit, Portland cement, etc. Applications for proposals should designate the schedules desired by number. E. B. Rogers, Paymaster General, U. S. N.

JACKSONVILLE, FLA.—George W. Clark has given a bond to the Board of County Commissioners for $10,000 to guarantee the building of a railroad from the city limits to Panama Park within a year.

BLUE RIDGE, GA.—The Council has decided to call an election to vote on the question of issuing $30,000 in bonds for water works and electric lighting.

CANTON, GA.—An election is to be held Sept. 21 to vote on the proposition to issue $29,500 in bonds for water works and electric lighting.

MILLEN, GA.—An election is to be held Sept. 16, to vote on the proposition of issuing $30,000 in electric light and water works bonds.

BOISE, IDA.—Rights of way have been secured by the Boise Electric Railway for extending its line to Barber Dam and to Table Rock, where it proposes to build a large hotel, and plans a summer resort.

EDWARDSVILLE, ILL.—The Illinois Traction system will install a new turbo-generator set of 9500 horse-power capacity at the Riverton power house.

MT. PULASKI, ILL.—The capital stock of the Independent Farmers' Telephone system has been increased from $8,000 to $25,000.

QUINCY, ILL.—The City Council has granted a franchise to the St. Louis, Terre Haute & Quincy Railway to operate its lines on several streets in the city.

COLUMBUS, IND.—The Grammar Telephone Exchange, together with the telephone lines in the Burnesville district, have been purchased by the Citizens' Telephone Company of this city. The local company recently purchased the Elizabethtown exchange and is after other lines in the county to connect up into a large system.

EVANSVILLE, IND.—Strouse & Brother are securing estimates for installing an extensive electric power plant.

KOKOMO, IND.—The Kokomo, Marion & Western Traction Company has placed an order with the Allis-Chalmers Company, of Milwaukee, Wis., for a duplicate of the 1000-kw turbine and alternator now installed, with turbo jet condensing system complete. The unit is wound for 60 cycles, two phase, 2300 volts. The second unit will furnish electricity for lighting and railway service.

LOGANSPORT, IND.—The local telephone company is contemplating installing an automatic telephone plant here.

CHICKASHA, I. T.—The City Council has granted a franchise to the Chickasha Water Power Company for a term of 25 years. The franchise carries with it a contract with the city to furnish 50 street lamps at the rate of $5.25 per lamp per month. The city is now paying $8 per month for each lamp. Work has commenced on the construction of its plant to be built on the Washita River, about three miles from the city. A steam plant will also be installed to use in case of emergency. Local men are at the head of the enterprise.

DENISON, IA.—The capital stock of the Crawford County Telephone Company has been increased to $120,000.

OSKALOOSA, IA.—The Oskaloosa Traction & Light Company has purchased an additional engine for its power plant.

CHANUTE, KAN.—The power plant of the Brunswick Oil & Gas Company is reported to have been completely destroyed by fire recently.

LEAVENWORTH, KAN.—The City Council on Aug. 28 passed the franchise of the Leavenworth Light & Heating Company in its revised form.

PARSONS, KAN.—A company has been formed at Kansas City to take over the projected railway of R. G. Rawlins, of Chanute, who promoted an interurban line from Chanute to Parsons, Cherryvale, Coffeyville and Independence. W. B. Henderson, of Kansas City, who is interested in the new company, states that construction will be commenced at once at Parsons, and also states that a power house will be built at Cherryvale to supply electricity for all the lines.

SALINA, KAN.—The contract for the new power house to be built by the People"s Light, Heat & Power Company has been let to W. H. Ringle.

COVINGTON, KY.—Owing to the refusal of the committee on light of the City Council to abide by the five-year recommendation, central Covington is without light. It is stated that the committee had made a proposition to the Union Light, Heat & Power Company to furnish arc lamps at $55 each per year, which the company accepted and asked the Council to have the Mayor approve the contract to cover five years.

JEFFERSONVILLE, KY.—The Jeffersonville Home Telephone Company, through James W. Fortune, secretary, has applied to the Board of Public Works for a franchise to operate an independent telephone system in opposition to the Cumberland Telephone & Telegraph Company.

LAKE CHARLES, LA.—The Lake Charles Street Railway Company is installing a 300-kw rotary converter in its power station and is rebuilding its car barns, recently destroyed by fire.

BALTIMORE, MD.—The question of installing arc lamps on Baltimore Street to replace the incandescent lamps now in use is being considered. Bids for incandescent lamps were asked for recently, and the contract is being held pending the decision on arc lamps.

BERLIN, MD.—The Mayor and City Council will receive bids until Sept. 20 for franchise to furnish electricity for lighting and water for the town.

OXFORD, MD.—The R. H. Pollard Company, of Baltimore, has placed a contract with the Oxford Ice & Electric Light Company to construct an electric plant to furnish electricity for lighting purposes in Oxford, also a plant for the manufacture of ice.

GREENFIELD, MASS.—The Greenfield Electric Light & Power Company has petitioned the Selectmen at Deerfield for rights to extend its line to Old Deerfield.

LOWELL, MASS.—The Boston & Northern Street Railway Company will soon place contracts for the construction of a single-track electric railway from Lowell to Lawrence, via West Andover, a distance of nine miles.

MALDEN, MASS.—The Malden Electric Company has applied to the Commissioner of Gas and Electricity for authority to issue $275,000 additional capital stock, the proceeds to be used to pay the floating debt and for additions to the plant.

NORTH ADAMS, MASS.—The Board of Selectmen has granted the petition of the Williamstown Gas Company for the right to erect and maintain a line of poles on the Bridges Road on the north side of the Hoosac River, which will enable the company to extend its transmission line from the Henderson Road to Sand Springs, where electricity will be furnished to light the sanitarium, bath houses and grounds of the Sand Springs. Dr. S. L. Lloyd is owner of the Sand Springs.

STOCKBRIDGE, MASS.—The Stockbridge Light & Power Company has nearly completed its conduit system and many residences have been connected with its lines. The switchboard has been placed at the new station and temporary connections have been made and electricity will be furnished as soon as the conduits are completed.

WINCHENDON, MASS.—A new engine is being installed in the power plant of the Winchendon Electric Light & Power Company.

ESCANABA, MICH.—The Escanaba Electric Power & Pulp Company is making plans to erect a plant on the site of the old Flat Rock Mill on the Escanaba River.

ESCANABA, MICH.—F. E. Hatch, of Pellston, is interested in a company which proposes to utilize Boney Falls on Escanaba River in Delta County. Application has been made to the Board of Public Works by Mr. Hatch to furnish electricity to operate the municipal electric light plant.

GRAND RAPIDS, MICH.—The franchise voted by the City Council to the Grand Rapids-Muskegon Power Company will be submitted to the people for ratification, the required 12 per cent of the voters having signed a petition for such action.

GRAND RAPIDS, MICH.—Low water in the Grand River has put many power dams out of commission temporarily. The feed wires for the Ionia street lamps have been connected with the Commonwealth Power Company's line to Jackson and electricity is being taken from the company's steam plant at that city, its dams on the Kalamazoo River being out of business because of the low water.

HOLLAND, MICH.—This city is considering the proposition of giving a trial this winter to the Grand Rapids-Muskegon Power Company's water electric power service or to repair and operate its lighting plant. Should a trial be given and prove successful, the city will contract with the company for electricity for a term of years. Repairs to the lighting plant would cost $30,000.

MUSKEGON, MICH.—Plans are being made by the Grand Rapids-Muskegon Power Company to erect four more power dams between the Rogers dam and Newaygo, making six dams in all which will develop a total of 60,000 horse-power. George L. Erwin is secretary.

WYANDOTTE, MICH.—Bids will be received until Sept. 17 by the Board of Public Works for the following electrical machinery: A 300-hp boiler, a 240-kw generating unit complete, generator panel, feeder panel, series enclosed alternating-current lamp system. James G. Pinson is secretary of the board.

ALBERT LEA, MINN.—The Hartland Telephone Company is making arrangements for the extension of its telephone lines from the terminus northwest of Freeborn into Matawan and from there west.

AURORA, MINN.—The City Council is reported to be considering the question of installing an electric lighting system.

BERMIDJI, MINN.—The Northwestern Telephone Company is contemplating making improvements to its system in this city and lines leading out of the city.

DAWSON, MINN.—Contracts for the electric light plant and water works have been awarded as follows: Tank, pumps and pipe line to W. D. Lowell & Company, Minneapolis; construction of building to J. W. Carson, Dawson; Muenzel gas producer engine of 80-hp capacity to the Minneapolis Steel & Machinery Company, Minneapolis; dynamos, switchboard and electrical appliances to the Westinghouse Electric & Manufacturing Company. The amount of the contracts will aggregate $25,000.

OXFORD, MISS.—The power plant of the University of Mississippi, which was destroyed by fire on Aug. 30, causing a loss of $10,000, will be rebuilt at once. It is reported that the city is contemplating the building of a municipal electric lighting plant in connection with the water works. The electric plant at the University also supplied electricity for lighting the town.

JEFFERSON, MO.—The Worth Mutual Telephone Company has increased its capital stock from $10,000 to $15,000.

MEADVILLE, MO.—There is a project on foot to establish an electric light plant in this place. For further information apply to J. H. Dunn.

ST. LOUIS, MO.—The St. Louis, Lakewood & Grant Park Railway will place contracts for construction of about six miles of additional track next month, for which franchises have just been granted. J. G. Hughes is chief engineer.

ST. LOUIS, MO.—Bids will be received until Sept. 20 by the Board of Public Improvement for furnishing and installing the following equipment in the Quarantine Hospital: Two engines; two generators; steam-heating system, together with certain steam fixtures and appliances; boilers, boiler furnaces, smoke connections, chimney, etc. Andrew J. O'Reilly is president of the board.

SPRINGFIELD, MO.—The promoters and stockholders of the new north side lighting and heating company, which was recently granted a franchise by the municipality, have decided to incorporate with a capital stock of $50,000. A. J. Eisenmayer is acting chairman of the company. It has been practically decided that the name chosen for the company will be either the Mutual Lighting Company or the People's Lighting Company.

WINDSOR, MO.—The plant and franchise of the Windsor Electric Light & Power Company have been sold to Messrs. Carver and Roberts, of Neosho, Mo., and Canyon City, Tex., respectively. The consideration was $7,200.

BILLINGS, MONT.—The power plant owned by the Yergen Brothers has been completed and has been in operation since Aug. 1. The City Council has granted Yergen Brothers a franchise to operate a street railway in the city, which will be voted upon by the people Sept. 14. As soon as the franchise is granted a new company will be organized under the name of the Yellowstone River Power Company. J. E. Brayton is manager of the Yergen Brothers power plant.

FLORENCE, NEB.—The Independent Telephone Company is contemplating the erection of a three-story exchange building in this place.

LOVELOCKS, NEV.—J. W. Gemkroger, secretary and treasurer of the Lovelock Light & Power Company, writes that the company has been incorporated with a capital stock of $25,000. The company is doing its own construction work.

RENO, NEV.—Henry W. Esden, formerly owner of the Wadsworth Light & Power Company, has organized a company composed of several San Francisco capitalists and is at present constructing a large power plant on the banks of the Truckee River, about seven miles east of this city. The plant will be one of the largest on the Truckee River, and besides furnishing electricity to Olinghouse, Fallon, Fairview and Wonder, will extend its lines to this city and enter into competition with the Reno Light, Power & Water Company.

BETHLEHEM, N. H.—Dr. G. H. Morrison, of Manchester, N. H., has purchased a controlling interest in the Bethlehem Electric Light Company, and will become its treasurer and general manager.

LINWOOD, N. J.—The Borough Council has voted in favor of lighting the streets of the borough by electricity. The Pleasantville Electric Light Company has submitted a proposition to furnish arc lamps of 1200 candle-power at $50 per lamp per year to burn until midnight.

NEWARK, N. J.—The contract for installing the municipal electric lighting plant in the city hall has been awarded to E. M. Waldron & Company, of this city, for $28,904.

PHILLIPSBURG, N. J.—A company is being organized by Phillipsburg capitalists to build an electric railway from Phillipsburg to Clinton, N. J. The road will be 30 miles in length.

TRENTON, N. J.—It is said that the Chamber of Commerce has taken up the old project of erecting a dam on the Delaware River above this city for the purpose of supplying electricity for lighting and power purposes in the city.

AMSTERDAM, N. Y.—The Eastern New York Railroad Company has been granted a franchise for a route into Amsterdam from Hagaman.

NEW YORK, N. Y.—McKesson & Robbins, of New York, N. Y., have contracted with Dodge & Day, engineers and contractors, of Philadelphia, Pa., to make additions to their present power plant. The additions will include a new engine, generator and the necessary changes in piping and wiring, etc.

ONEIDA, N. Y.—Surveys are now being made for the extension of the Oneida Railway to Kenwood.

OWEGO, N. Y.—The Ithaca & Owego Traction Company has applied to the Board of Trustees for a franchise to construct and operate an electric railway in this village.

ROCHESTER, N. Y.—Bids will be received until Sept. 30 by the Commissioners of Public Buildings of Monroe County for furnishing and installing an electric lighting plant in the basement of the court house. G. L. Meade is chairman.

SCHAGHTICOKE, N. Y.—The Schaghticoke Electric Company, which is now constructing an electric power plant on the Hoosick River in this place, has filed in the country clerk's office an amended certificate of incorporation extending the field of its operations to Schenectady and Montgomery counties as well as Rensselaer, Saratoga and Albany counties. George E. Greene is president.

ASHEVILLE, N. C.—The Asheville Rapid Transit Company will soon place contracts for the construction of two and one-half miles of track in the city.

KINGS MOUNTAIN, N. C.—Bids will be received until Oct. 3 by F. L. Carpenter, town clerk, for $50,000 water, light and improvement bonds.

RALEIGH, N. C.—The Raleigh Electric Company is now building a new power station and coal storing pockets, and has recently placed contracts for the following equipments: One 500-kw, General Electric turbo-generator; Alberger condenser; cooling tower; one 500-hp Stirling boiler; a 150-kw motor generator set, and also three new semi-convertible cars from the Southern Car Company.

CLEVELAND, OHIO.—The street lighting service will be extended by the installation of 125 arc lamps immediately. Charles Kibbie is superintendent of lighting.

CLEVELAND, OHIO.—The Cleveland Electric Illuminating Company is contemplating the construction of a generating plant on the Lake Shore. Involved in the scheme is said to be the construction of a tunnel into the lake to supply the plant with water. C. W. Schultz, chief engineer of the Water Department, will prepare plans for the plant.

NORWALK, OHIO.—J. Y. Boyd, of Toledo, financial agent of the new interurban road from Cleveland to Indianapolis via Norwalk and Bluffton, Ind., has signed a contract with Western capitalists, who will supply funds to build the road at once.

TOLEDO, OHIO.—The council committee on gas and light has approved the ordinance granting the People's Heating & Lighting Company the privilege to use the streets of the city.

YOUNGSTOWN, OHIO.—The Lake Erie & Youngstown Electric Railway has completed plans for the road to enter Youngstown, connecting with the Youngstown & Southern Railway Company. The right of way has been secured to Conneaut and work will soon be started. A. W. Jones and John H. Puhlman are interested in the project.

YOUNGSTOWN, OHIO.—G. L. Wells, chief engineer of the construction force of the Youngstown & Ohio Interurban Electric Company, states that $1,000,000 will be invested in building and equipping the new road. The Cleveland Construction will construct the road, which is expected to be in operation by Sept. 1, 1908. A power house is now under construction at West Point, and a reserve plant will be maintained at Leetonia for emergency purposes. The main office of the company will be at Leetonia.

DAYTON, ORE.—The City Council is securing estimates for the cost of a water turbine and dynamo with the view of establishing an electric light plant in this city.

PORTLAND, ORE.—Contracts will soon be let for the construction of an electric plant at Katolla, Alaska, to generate 1500 horse-power. The Guggenheim interests are behind the work.

PRINEVILLE, ORE.—The Prineville Light & Power Company is contemplating installing a power plant on the Matoles next year to supply the whole county with electricity.

SALEM, ORE.—A. Welch, of Portland, has applied to the City Council for a franchise over several streets of the city from the northern to the southern limits with outlet to the Willamette River for an entirely new electric railway system.

DONORA, PA.—C. A. Richter and George W. Moore, of Pittsburg, said to represent Pittsburg capital, have been in the town in the interest of a project to build an electric railway to connect Donora with the Pittsburg-Charleroi line at Eldora. Surveys have been made for the road to cut across the country to Eldora by the way of South Donora.

KITTANNING, PA.—The Kittanning & Leechburg Railways Company is contemplating building three miles of track, and is also in the market for a 250-hp gas engine.

LANCASTER, PA.—Surveys are being made for the Conestoga Traction Company for an electric railway from Gap to Parkersburg, which will connect the electric railway system of Lancaster County with a line running to Philadelphia. The Philadelphia & Western Company is also preparing to extend its line through to Parkersburg.

PHILADELPHIA, PA.—Bids have been asked by George R. Stearns, director of public works, for additional pumps and dynamos for the Torresdale plant as follows: One 1,000,000 and one 2,500,000-gallon centrifugal pumps, at an estimated cost of $60,000; three generators for electric lighting and driving the air blowers for the preliminary filters, the cost of which is estimated at $25,000.

PINE GROVE, PA.—It is reported that the farmers of Pine Valley are considering a project of building an electric railway through that section, connecting Tremont and Pottsville.

POTTSVILLE, PA.—The Pottsville Union Traction Company is contemplating the construction of a new electric railway from Minersville, the present terminus of the lower Schuylkill line, to Hegins and Millersburg, returning to Ashland by the way of Gordon through Mabel.

READING, PA.—The Board of Park Commissioners is contemplating installing electric cables in conduits in the City Park, and to have the lamps suspended from ornamental iron poles.

WATERFORD, PA.—Articles of incorporation will soon be filed for the Waterford Electric Light Company by Betram E. Waltz, Allyne C. Hovey and Charles Himrod. The company proposes to supply electricity for lighting, heating and power purposes in the borough of Waterford.

PHILLIPSDALE, R. I.—The Washburn Wire Company has awarded the contract for the construction of its manufacturing plant, estimated to cost $300,000, to the E. K. Watson Company, of Warren, R. I. The plant includes wire mill, annealing building, rod mill, boiler house and engine house. Leon H. Allen, of the American Electric Works, of Phillipsdale, is the architect.

AIKEN, S. C.—A. Ludlow, manager of the Carolina Light & Power Company, writes that no contracts will be let in connection with the development of the Anderson Shoals for electrical purposes. All work will be done by day labor. The cost of the work is estimated at $40,000.

CHARLESTON, S. C.—Bids will be received at the office of Ion Simons, city electrician, until Nov. 15 for lighting the streets and public buildings of the city for a term of one, two and four years from June 30, 1908, with electricity, gas or some other illuminating system. Bids will also be received for lighting both by gas and electricity.

YORKVILLE, S. C.—Work has commenced on the construction of the plant for the Lockmore Cotton Mills in this place. The building will be 75x300 feet. It will have a capacity of 6500 spindles and will be operated by electricity. Thomas F. Moore is president of the company.

ABERDEEN, S. D.—The City Council has granted a franchise to C. F. Freehauf, of Creston, Iowa.

YANKTON, S. D.—The City Council has granted a franchise to build a single-track railway along First Street and Broadway to the Yankton & Southern Railroad, which is being promoted by Fremont Hill.

GLEASON, TENN.—W. H. Williams, general manager of the Gleason Water & Light Company, writes that probably nothing will be done this year on the construction of the electric light plant.

MEMPHIS, TENN.—The question of constructing a municipal electric lighting plant is now under consideration.

NASHVILLE, TENN.—The Southern Electric Company of this city has contracted to install a complete electric lighting plant at Ruskin, near Charlotte.

BROWNSVILLE, TEX.—The City Council has awarded the contract for the construction of the electric light plant and water works system to the American Light & Water Company for $65,940.

CALVERT, TEX.—James J. Henry, of Denver, Col., is promoting a project to build a power plant at this place to furnish electricity for light and power purposes.

EL PASO, TEX.—The County Commissioners have granted a franchise to J. E. Gibbs to construct and operate an interurban street railway between El Paso and San Elizario.

HOUSTON, TEX.—E. C. Lamb is organizing a company with a capital stock of $50,000 to build a plant to manufacture electric dry kilns.

TERRELL, TEX.—A. M. Woolley, city secretary, writes that no engineer has been employed as yet to prepare plans for the electric light plant, which is to be constructed at a cost of $15,000.

WACO, TEX.—It is reported that the money needed for the establishment of the electric power plant in Milam County, about 60 miles south of Waco, has been subscribed by Texas and Eastern capitalists. The company has been granted a franchise by the City Council to erect and maintain transmission lines to furnish electricity in this city. It also proposes to supply electricity in the city of Houston and electrical power to operate an interurban railway in Central Texas. Joseph J. Henry is said to be managing the enterprise.

MONTPELIER, VT.—The City Council has granted a franchise to Frank M. Corry, E. H. Deavitt and I. M. Frost to erect poles and wires in the streets of the city for the transmission of electricity from their proposed plant on the Winooski River near the towns of Barre, Berlin and East Montpelier.

PITTSFORD VT.—Surveys are being made in the vicinity of Furnace Brook for the Vermont Marble Company. The company proposes to develop the water power of this stream and build a power house on the site east of the Pittsford Mills. The plan is to use steel tubing between the reservoir and the power house.

EVERETT, WASH.—J. T. McChesney, of the Everett Improvement Company, and associates will soon begin construction of an electric railway between Snohomish and Fall City, a distance of 35 miles. Surveys have been completed for the road, which will pass through Cherry Valley.

EVERETT, WASH.—The street railway system, which was taken over Sept. 1 by the Stone & Webster interests, has been embodied in the Puget International Railway Company, a new corporation which has been organized to build and operate a system of interurban electric railways connecting Seattle and Tacoma and projected as far south as Grays Harbor. At present the Everett street railway system is operated by electricity generated by a steam plant owned by the company. The system ultimately will be operated by electric energy furnished by a new plant at the falls of Noosack River in Whatcom County, which is now being installed by Stone & Webster. The Whatcom County power plant will be connected with that of the Puget Sound Electric Railway Company at Electron and a new plant will be built on the upper White River. Steam auxiliary plants at Seattle, Georgetown and Tacoma will be used with the main system as reserve stations.

SEATTLE, WASH.—The lamp and lighting committee of the City Council has granted the Seattle-Tacoma Power Company an extension of three years in time to place its wires underground in the downtown section of the city. The underground system will cost the company $400,000 and is to be completed by Jan. 1, 1912.

SEATTLE, WASH.—The Board of Public Works on Aug. 24 approved the plans and specifications for the cluster lamps that have been ordered installed by the City Council in the downtown district. It is reported that bids for the installation will be received by the Board of Public Works in about three weeks, the cost of which is estimated at about $175,000.

TOPPENISH, WASH.—The Council is considering granting a water and light franchise to T. H. Noble, of North Yakima.

ELKINS, W. VA.—Bids will be received by the county court (Lee Crouch, clerk) until Sept. 23, for electric and gas fixtures for the court house now being erected.

MANNINGTON, VA.—Albert M. Schenck, of Wheeling, has purchased the plant and holdings of the Mannington Light & Power Company. The line will be extended and made a link in a proposed traction system from Fairmont to Wheeling by the way of Mannington, Clarksburg and Moundsville.

MORGANTOWN, W. VA.—George C. Sturgess, president of the Sabraton Street Railway Company, is promoting a plan to build a traction system from the Fairmont region in West Virginia to the Connellsville coal region in Pennsylvania by the way of the Monongahela River to Point Marion and thence to Connellsville. Work on the line to Point Marion will commence at once.

ANTIGO, WIS.—Henry Sherry, of Neenah, is contemplating developing a water power on Wolf River.

EAU CLAIRE, WIS.—The Chippewa Valley Railway, Light & Power Company is in the market for a 225-kw, 600-volt railway generator, either new or second hand, and two interurban cars.

LA CROSSE, WIS.—The La Crosse Water Power Company, which is building a large hydro-electric power plant at Hatfield, is making arrangements to furnish electricity for lighting and power purposes to towns and villages in southern Minnesota, including Caledonia, Spring Grove, Preston, Houston, Hokah and other places in Fillmore and Houston counties. Franchises will soon be asked of the village boards and town councils.

SUPERIOR, WIS.—The City Council has decided to make a contract with the Superior Water, Light & Power Company for street lighting. The contract is for one year, with an option to lengthen it to five years. The question of building a municipal electric light plant has been abandoned for the present.

WALWORTH, WIS.—The sale of the Chicago, Harvard & Geneva Lake Electric Railway to the Elgin, Belvidere & Rockford Electric Road interests has been consummated, and it is said that the latter company will extend the line of the Chicago, Harvard & Geneva Railway from Harvard to Marengo, and will also soon begin surveying for an extension of the road to Elkhorn, Wis., touching Delavan Lake at its eastern end. It is expected to have the entire line equipped for service by early spring. The new deal will involve an expenditure of about $600,000 in addition to the power plant at Walworth, making it a central station for the entire line.

CALGARY, ALB.—The Alberta Portland Cement Company has applied to the City Council for concessions for the development of electric power at Radnor.

REVELSTOKE, B. C.—The date for receiving tenders on the hydro-electric plant for this city has been extended until Sept. 30. Address Mayor Brown.

VANCOUVER, B. C.—Orders will soon be placed in the near future by the British Columbia Electric Railway Company for material needed in the overhead work for the proposed electric railway between New Westminster and Eburne. Work has commenced on the line between New Westminster and Chilliwack, which will be 62 miles in length and will cost about $2,500,000.

MINNEDOSA, MAN.—Water for the proposed power plant to be erected here will be obtained from Clear Lake, 30 miles north, where a dam will be constructed. For further information address E. O. Denison.

WINNIPEG, MAN.—The civic power committee has decided to extend the time for receiving tenders for its $3,500,000 power development until Oct. 1, in order that European firms may submit tenders. Plans and specifications may be seen at the office of Cecil B. Smith, civic power expert, Winnipeg, Man.

DURHAM, ONT.—The Northumberland & Durham Power Company is considering the question of transmitting electricity to Kingston. The plant will be located at Healy Falls.

MILBROOK, ONT.—J. Davidson, of this town, has purchased the local electric lighting plant and has secured a contract for lighting the town.

OTTAWA, ONT.—The Municipal Electric Commission has made a recommendation to the City Council that it be authorized to make the following offer to Messrs. Gilmour and Hughson, the owners of the

Chelsea power, that one-half the bed of the Gatineau River at the fall at Chelsea, with the right to take water enough from the river to develop 25,000 horse-power, be purchased by the city for the sum of $200,000, and that in addition the city agrees to build, within ten years, a dam across the entire river capable of establishing an 80-foot head at the water power.

TORONTO, ONT.—The Hydro Electric Power Commission, of this city, has sent out a fourth surveying party to locate the transmission line from Hamilton to Guelph, Berlin, St. Mary's and Stratford.

Company Elections.

CLOVERDALE, CAL.—At the annual meeting of the Cloverdale Light & Power Company, held recently, the following directors were elected: A. Sbarbaro, P. C. Rossi, A. E. Sbarbaro. A. Sbarbaro is president of the company and A. E. Sbarbaro is secretary.

ROCKVILLE, IND.—At the recent annual meeting of the directors of the Parke County Telephone Company the following officers were elected: A. M. Adams, president; L. N. Whitney, vice-president; C. L. McNaughton, secretary-treasurer, and M. R. Ufriehard, auditor. The question of installing new equipment and making extensions was considered.

New Industrial Companies.

THE SECOND HAND MACHINERY COMPANY has been formed at Kansas City, Mo., by Edward R. Royer, Ralph B. Coleman and George B. Wandling. It will make a specialty of the purchase and sale of new and second-hand electrical and steam machinery for power stations and power applications. The company's office is in the Sheidley Building, suite 448-50.

THE TELHARMONIC SECURITY COMPANY, of Jersey City, N. J., has been incorporated with a capital stock of $125,000. The company will deal in securities, etc. The incorporators are: John C. Lowe, Oliver C. Reynolds and John R. Turner.

New Incorporations.

CITRONELLE, ALA.—The Citronelle Light & Power Company has been incorporated with a capital stock of $25,000 by J. A. Shannon, E. E. Shannon and H. H. Orr. The company has been granted a franchise to manufacture and distribute electricity for lighting and power purposes and also to manufacture ice. J. A. Shannon is president.

SAN FRANCISCO, CAL.—Articles of incorporation of the Stockton Gas & Electric Company were recently filed with the county clerk, together with a certificate of bonded indebtedness. The capital stock is placed at $1,500,000, and the bonded indebtedness is for a like amount. The directors are: A. H. Winn, Paul McDonald, R. T. Hooper, H. F. Allen and J. T. Handy.

MONTEZUMA, COL.—The Montezuma Power & Light Company has been incorporated with a capital stock of $50,000 by Geo. L. Nye, B. B. Morrison and R. W. Wagner.

DOVER, DEL.—Incorporation papers have been filed for the Van Buren Fuel & Light Company by the Corporation Trust Company of America. The company is capitalized at $25,000, and the directors are James S. Cummings, R. T. Graf and R. A. Wortman, all of Chicago, Ill.

AMERICUS, GA.—A charter has been granted by the Secretary of State to the Americus Railway & Power Company. The company is capitalized at $250,000 and proposes to construct four miles of street railway, to install an up-to-date electric lighting plant, and in addition will pump water for the city for the next 20 years.

EMMETSBURG, IA.—The Spirit Lake, Emmetsburg & Fort Dodge Railway Company has filed articles of incorporation with a capital stock of $20,000. The company proposes to construct an interurban railway from Fort Dodge to Spirit Lake. Plans are being made to erect a large dam across the Des Moines River about seven miles north of Fort Dodge and build a hydro-electric plant at this point, which with a steam auxiliary plant at the north end of the line is expected to furnish sufficient power to operate the cars.

ST. ANSGAR, IA.—The St. Ansgar Light & Power Company has been incorporated with a capital stock of $10,000 by A. N. Lund and others.

ELLSWORTH, MAINE.—The Monterey Hydro-Electric Power Company has been incorporated with a capital stock of $5,000,000 by William E. Whiting, Perry Langley, R. H. Whiting, H. F. Drunemey, E. B. Doyle, M. F. Doyle and E. K. Whiting, Ellsworth.

LIMERICK, MAINE.—The Limerick Water & Electric Company has been incorporated with a capital stock of $500,000 by Charles G. Moulton, Ralph Clark, Charles H. Adams, of Limerick; J. Merrill Lord, of Parsonsfield; John F. Moore and Ira H. Moore, of Newfield. The company has a legislative charter granting it the right of eminent domain in the towns of Limerick, Newfield and Waterboro.

EXCELSIOR SPRINGS, MO.—Articles of incorporation have been filed for the St. Joseph, Excelsior Springs & Lexington Railway Company by Dr. G. P. Lingenfetter, Charles Dyer, of Denver; C. D. Wade, A. M. Bates, S. S. McIntire, of Excelsior Springs; W. J. Bates, of Hibbard, and D. C. Finley, of Kansas City. The company is capitalized at $200,000.

BATH, N. Y.—The Bath Electric Service Company has been incorporated to construct and operate an electric railway in Bath, N. Y. The capital stock is placed at $100,000 and the incorporators are: Luther H. Leber and Frederick M. Dayton, of Buffalo, and Arthur Lozier.

NIAGARA FALLS, N. Y.—The Niagara Falls Lighting Company has filed articles of incorporation with the Secretary of State with a capital stock of $100,000. The directors are Austin McCausland, William J. Bagnell, of New York, and James E. Rock, of Niagara Falls.

FERRIS, TEX.—The Ferris Light & Power Company has been incorporated with a capital stock of $4,000 by W. W. Batchelor and others.

Legal.

WIRELESS TELEGRAPH PROMOTION.—At Trenton, N. J., on Sept. 5, argument was made on the motion to set aside the purchase by Abraham White, of the John A. McCall country seat on Norwood Avenue, before Judge William M. Lanning in the United States Circuit Court. The motion was made in the suit of Walter Althouse against the De Forest Wireless Telegraph Company and the Abraham White Realty & Improvement Corporation. Mr. Althouse is a stockholder in these companies, and he seeks to have the purchase of the McCall property adjudicated, asserting that White bought it with money of the company. The property is one of the finest in the State and cost upward of $1,000,000. White was supposed to have purchased the property at a sacrifice, with one day's earnings on a bull market in Wall Street, from a syndicate headed by Myron H. Oppenheim, which bought the property when Mr. McCall was pressed for funds during the insurance investigation. Oppenheim, it is said, paid a trifle over $200,000 for it. White was reported to have given $500,000 for the place, but the exact figures were never made public.

TAXATION OF TELEGRAPH WIRES UNDER THE STATUTES OF IOWA.—The Chicago, Burlington & Quincy Railroad Company owns approximately 800 miles of telegraph lines and equipment in the State of Iowa, situated on the company's right of way between Burlington and Council Bluffs, Iowa. In addition to using their lines for railroad purposes they were leased to the Western Union Telegraph Company. The statutes of Iowa provide that no telegraph line shall be assessed which is owned and operated by any railroad company exclusively for the transaction of its business, and duly reported in the railroad's annual report for taxation. The railroad company erroneously included its telegraph line in its return of taxable property as a part of its railroad property, under the Iowa statute which provided for the taxation of railroad property and the company voluntarily paid the tax assessed. In an action by the company against the country treasurer to recover back the tax which it had paid, it was held that although the property was not taxable under the section of the statute referred to, it should have been taxed under another provision of the statute for the taxation of telegraph companies, and that the railroad company was not entitled to a refund of the tax. Chicago, Burlington & Quincy Railroad Company vs. Rhein, Supreme Court of Iowa, 112 N. W. Rep. 823.

RIGHT OF INTERURBAN ELECTRIC RAILWAY TO CONDEMN LAND FOR RIGHT OF WAY IN WISCONSIN.—The Milwaukee Light, Heat & Traction Company, having commenced a proceeding to condemn land for right of way for an electric railway in the County of Milwaukee, Wis., its right to do so was denied by the Milwaukee Northern Railway Company, operating a steam railroad, the latter company claiming that it had already acquired option contracts covering eight of the nine miles of the disputed right of way, together with the necessary franchises, and that the former company had not in any event the right to take land by condemnation. The facts show a contest between two corporations, one a steam railroad and the other an electric railway, each attempting to acquire the same strip of land for its right of way, the electric railway by condemnation and the steam railroad by purchase. After indulging in a lengthy investigation of the condemnation statutes, the court concluded that, under them, interurban electric railways were authorized to exercise the power of eminent domain. The steam railroad advanced a further argument that it was first on the ground and had acquired a prior right to the land in question by being secured by option contracts. It was shown that the stockholders of the steam railroad company had advanced money for the purpose of laying the proposed right of way, and that resolutions had been adopted by the directors authorizing the acquirement and all necessary rights and franchises and appropriating money to pay for the right of way on which options had been secured. And it was held that these acts constituted a complete location, and, hence, that the electric company could not later come in and seize the same property for its right of way. In re Milwaukee Light, Heat & Traction Company, Sup. Ct. of Wisconsin, 112 N. Y. Rep. 663.

SALE OF TELEPHONE LINE AND EQUIPMENT.—In a recent case arising in the Supreme Court of Iowa it appeared that the plaintiff had agreed to sell to the defendant a certain telephone system, and material and instruments on hand, or used in connection with the system, for a sum to be fixed by designated appraisers. The sale was to include telephone poles, lines, rights of way, and the right to maintain the lines and poles as originally erected. The appraisers found that the fair value of the property to be transferred under the contract was $7,500. The bill of sale which was subsequently made provided for the transfer of "a line of telephone poles and wires, and rights of way for the maintenance of the line as now constructed." It was warranted that the property was clear and free from encumbrance, and that the seller had good

and lawful authority to sell and convey the same. After paying $7,000 the defendant held up the balance due on the ground that it had not received all that it had bargained for. Evidence was introduced which tended to show that, over certain farms through which plaintiff's line passed, the plaintiff, instead of owning absolutely a right of way, had only a permissive right to erect poles and run telephone wires, subject to be revoked at the pleasure of the owners, and that the plaintiff did not have a right of way which would entitle him to maintain his lines through these farms, and to enter the farms for the purpose of making repairs as against the objection of such owners. The defendant contended that this was inconsistent with the plaintiff's warranty that the property was free from all encumbrances. The court decided that the contract did not contemplate the conveyance of an absolute right of perpetual maintenance of the lines where constructed, but only the right which seller was enjoying at the time of the transfer. As far as this contention was concerned, then, the plaintiff was entitled to recover the balance due, but it appeared that the contract also provided for delivery of certain materials and instruments, and the plaintiff offered no proof that the materials and instruments had ever been delivered. For this reason, it was held that the court would not be justified in directing a verdict for the plaintiff. Lattner vs. Interstate Telephone Company, 112 N. W. Rep. 653.

Obituary.

MR. FRANKLIN H. SPIESE, of Tamaqua, Pa., died suddenly Aug. 30, while conversing with friends in the Elks' Club. Mr. Spiese was one of the most prominent business men of that part of the state. He was president of the Tamaqua National Bank, originator of the Edison Electric Illuminating Company and the Tamaqua & Lansford Street Railway Company, now merged into the Eastern Pennsylvania Railway Company, and was a director in the Cumberland Valley Telephone, the American Subway and the Schuylkill Subway companies, and was also vice-president of the United Haiti Improvement Company.

MR. W. J. PHELPS—It is with deep regret that we have received news of the death, after a brief illness, of Mr. W. J. Phelps, on Sept. 3, at the Grace Hospital, Detroit, of inflammation of the brain. He underwent a mastoid operation on Aug. 28. Mr. William Joshua Phelps was born in Elmwood, Ill., Nov. 19, 1866. He was a graduate of Knox College, Galesburg, Ill., and was a member of the Illinois Delta of Phi Delta Theta fraternity. He was an electrical engineer and inventor. The most well-known and useful of his inventions was the "Hylo" lamp, which he manufactured in its various forms. He is credited with being the originator of the turn-down lamp art, which has proven to be an extensive business. He was also the inventor of the Phelps motorless flasher, which has proven to be of great use in the electrical advertising field. He was a member of the American Institute of Electrical Engineers, the American Society for the Advancement of Science, the Society of Illuminating Engineers and the Detroit Engineering Society. He leaves a widow and two children, his father, Mr. W. E. Phelps, mother, brother and sister. He was well known in the electrical trades.

MR. J. L. GAYLORD.—Mr. James L. Gaylord, 37 years old, was found dead in a rear room of the apartment on Sept. 8 in New York City by a colored porter. Coroner Harburger was called, and after an examination, it was found that death was due to acute kidney trouble. Mr. Gaylord, who is a nephew of James W. Paul, Jr., of the banking firm of Drexel & Company, of Philadelphia, has been an electrical engineer with headquarters in New York for the last sixteen years, and was very well known, both here and in Philadelphia in business and social circles. He was dining on Saturday night with a companion, Mr. Schultz, also an electrical engineer, who has an apartment at the same number as Mr. Gaylord, at the Café Martin, when Mr. Gaylord complained of a slight illness. His companion advised him to go home and rest, which he did. At about 10.30 o'clock on Saturday night Mr. Schultz called at Mr. Gaylord's apartment on his way home, but after continued knocking got no response, from which the police judge that he probably was dead at that time. Mr. Gaylord had given up several years to pushing the Arnold monophase patents, of European origin, and more lately was deeply interested in new processes of electroplating.

Personal.

PROF. M. DEHN, associate professor of electrical engineering at the Stuttgart, Germany, Polytechnicum, is making a tour of the principal electrical centres of this country.

MR. CALVIN W. RICE, secretary of the American Society of Mechanical Engineers, has just returned from the Continent of Europe with his wife, who was ordered abroad to take the waters at one of the German spas. Mrs. Rice is thoroughly restored in health.

MR. THEODORE H. BAILEY, who was assistant general manager of the General Electric Company for 20 years, has been appointed general manager of the Kobusch Automobile Company, St. Louis. Mr. Bailey has arrived in St. Louis from Chicago and has taken charge of the plant.

MR. WM. W. MERRILL has resigned as president of the Appleton Electric Company, of Chicago, and disposed of his entire stock holdings to Mr. Albert I. Appleton and Mr. John V. Painter. Mr. Appleton assumes the presidency of the company, of which he is also treasurer, and Mr. Painter becomes secretary.

MR. W. E. HARRINGTON, president and general manager of the Eastern Pennsylvania Railways Company, of Pottsville, Pa., has resigned the latter position and will retain his position as president of the board of directors only, relinquishing the management to Mr. L. C. Bradley, who has been associated with the company since last June. Mr. Bradley will fill the office of general superintendent and general manager.

Business Notes.

THE MAPLE LEAF AUTOMOBILE & ELECTRICAL MANUFACTURING COMPANY, of Galt, Ont., has changed its name to the Galt Electrical Manufacturing Company, Ltd.

BOSSERT ELECTRIC CONSTRUCTION COMPANY, of Utica, N. Y., has disposed of the switchboard and panelboard department of its business to the N. Y. Electric Switchboard Company, of Twenty-eighth Street and First Avenue, New York City, which has acquired the sole right to manufacture the Bossert type of switches and panelboards. The former superintendent of the department will be in charge of the new factory, which will be represented by R. B. Corey & Company, of 39-41 Cortlandt Street, as sales agents.

THE PITTSBURG GAGE & SUPPLY COMPANY, Pittsburg, Pa., has installed White Star continuous oiling systems in the engine rooms of the Fitchburg Yarn Company, Fitchburg, Mass.; Indianapolis & L Traction Company, Scottsburg, Ind.; Berwind-White Coal Mining Company, Windber, Pa.; Tennessee Coal & Iron & R. R. Company, Ensley, Ala.; Seconnet Mills, Fall River, Mass.; American Sheet & Tin Plate Company, Vandergrift, Pa.; American Bottle Company, Newark, Ohio; Bethlehem Steel Company, South Bethlehem. Pa., and Diamond Rubber Company, Akron, Ohio. The great saving in lubricating oil, requiring but one handling (from barrel to system) by human means, its constant use, being cleaned by the White Star filter after passing through the bearings, and thence used over and over again until actually worn out, render the use of an oiling system an actual necessity in every up-to-date power plant.

Weekly Record of Electrical Patents.

UNITED STATES PATENTS ISSUED SEPT. 3, 1907.

[Conducted by Rosenbaum & Stockbridge, Pat. Attys., 41 Park Row, N. Y.]

864,765. SAFETY HANGER; Richard Anteau, West Toledo, Ohio. App. filed Feb. 19, 1906. A form of suspension strap or hanger for supporting conductors from a messenger wire. Includes a U-shaped wire clip with lapped ends which receive a flexible strap surrounding the conductor.

864,781. UNIVERSAL OUTLET OR JUNCTION BOX; John L. Gleason, Boston, Mass. App. filed May 31, 1906. Relates to outlet boxes for joining the wires of sealed electric wiring system to electric light and other fixtures. Covers details of construction.

864,782. TUMBLING BARREL; Harry J. Guttman, Chicago, Ill. App. filed Aug. 7, 1905. A drum or barrel open at one end is revolved on an inclined axis which can be varied by reason of the bevel gear arrangement employed for driving the barrel.

864,840. APPARATUS FOR ELECTRICALLY REMOVING AND SEVERING METAL; Royal E. Frickey, Berkeley, Cal. App. filed June 29, 1906. Relates to an apparatus or machine for electrically removing, cutting or severing metallic structures, such as beams and metal work in general. Has an electrode and a graphite holder for the same having an interior bore of two diameters.

864,842. ELECTRIC DRIVE FOR PAPER MAKING AND LIKE MACHINES; James R. Happer, Linwood, Scotland. App. filed Jan. 4, 1907. A system for electrically driving paper-making machines composed of sections where the relative speeds must be capable of variation, as, for example, to provide for the suitable draw of a paper or web through a paper-making machine.

864,858. AUTOMATIC CIRCUIT CLOSER; Hermann G. Pape, New York, N. Y. App. filed June 16, 1904. The combination with a receiver, of a circuit closer, and a head band for the receiver constituting operating means for moving the switch to closed position upon the positioning of the head band and receiver upon an operator.

864,866. AUTOMATIC TRAIN STOP; Hiram G. Sedgwick, Mill Valley, Cal. App. filed Nov. 28, 1906. The track rails are constructed with long and with intermediate short insulated sections, and special contact plates are also employed engaged by a brush or shoe on the train. This arrangement closes the circuits for operating the train-stop relay magnets.

864,887. SUPERVISORY SYSTEM FOR TELEPHONE LINES; William W. Dean, Chicago, Ill. App. filed Jan. 25, 1904. Relates to cord and subscribers' circuits for a telephone system.

864,888. TROLLEY-WIRE CROSSOVER; David H. Doak, Morgan Park, Ill. App. filed Oct. 11, 1905. Relates to crossovers in connection with overhead trolley systems used on electric railways. Is designed to insulate the trolley wires from one another and at the same time permit high-speed passage of cars in both directions. Has normally depending plates which are swung upward to establish a bridge across one of the trolley wires and constituting a continuation of the other.

864899. STEP SWITCH; Christian Kramer, Frankfort-on-the-Main, Germany. App. filed Jan. 16, 1907. A step by step switch comprising an

operating lever and a contact lever together eccentrically mounted with relation to each other, and engaging devices on the levers whereby they are in operative connection only during a portion of the movement of one of the levers in one direction.

864,909. SOUND-PRODUCING DEVICE; John P. Northey, Toronto, Ontario, Canada. App. filed July 9, 1906. Fog signaling siren of the type having a cylinder with air orifices and a reciprocating cushioned piston having a head working in an enlargement of the cylinder and having tranverse orifices.

864,912. JOINTED TROLLEY POLE; Harry Padley, Elyria, Ohio. App. filed June 1, 1906. A trolley pole having a hinge substantially at its middle and the hinged members constructed each with an abutting face at an inclination to a right angle whereby the trolley pole will buckle or bend when the car backs against an obstruction, thereby avoiding breakage.

864,915. ELEVATOR SIGNALING APPARATUS; Charles A. Reiners, Hoboken, N. J. App. filed April 9, 1907. Relates to an elevator signaling apparatus, and provides a construction by which an attendant may control the movement of the elevator cars in order to have them make their trips with regularity.

864,928. ELECTROLYTIC PRODUCTION OF EARTH-ALKALI METALS; George O. Seward and Franz von Kugelgen, Holcombs Rock, Va. App. filed April 25, 1906. Maintaining the current density at a submerged cathode so high that the metal is formed in a molten state, and cooling the metal which separates from the cathode while it is passing through the electrolyte.

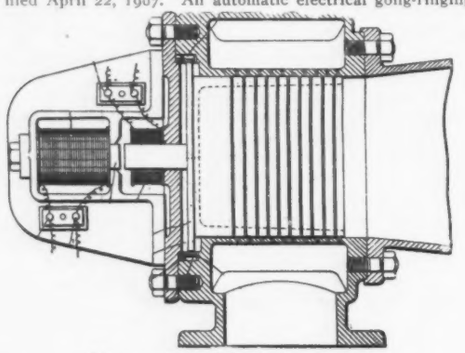
864,947. CLAMP FOR ELECTRIC WIRES; Elisha W. Buffington, Fall River, Mass. App. filed May 1, 1907. A cylindrical insulator pin having two portions with parallel grooves which cooperate to receive conductors between them. The surfaces of the grooves are roughened so as to clamp the conductors more tightly.

864,950. TELEGRAPH TRANSMITTER; Josiah A. Carter, Jr., Atlanta, Ga. App. filed March 4, 1907. Has a vibrator extending beyond the pivotal point of the key lever, speed adjusting screw weights, and an auxiliary lever or bar contacting with the vibrator and with the key lever, a movable stop, and a key lever controlling the action of the vibrator.

864,957. PORTABLE SEARCHLIGHT; John Dickens, Passaic, N. J. App. filed Oct. 8, 1904. A portable electric lamp of the type having a plurality of dry batteries in a cylindrical casing and a miniature incandescent lamp at one end. Relates to features of switch plug by which the circuits are controlled.

864,959. TANK ALARM; Glen F. Elliott, Delmar, Del. App. filed April 20, 1907. A carriage slides vertically between suitable ways, being controlled by a float in the tank. At the limits of its movement it completes alarm circuits.

864,961. AUTOMATIC ELECTRIC GONG-RINGING DEVICE FOR STREET CARS; Nathan Fallek and George F. Wolfe, Denver, Col. App. filed April 22, 1907. An automatic electrical gong-ringing device



864,909.—Sound-Producing Device.

for street cars. Provides means for automatically and continuously ringing the gong when a car is standing still unless the motorman holds the crank handle against the stop post of the controller.

864,968. MULTIPLE NEEDLE HOLDER FOR ELECTROLYSIS; Edward W. Johnson, Chicago, Ill. App. filed June 28, 1907. An apparatus in which a considerable number of depilatory needles are supported on independent bracket arms so that they can be used simultaneously.

864,971. ELECTRIC SIGNALING DEVICE; Alfred Larsson, Buffalo, N. Y. App. filed June 9, 1906. Construction of electric vibrator bell having a magnet, the yoke of which supports the bell, forming a housing for the magnet. The armature is angularly disposed within the bell or casing as as to strike against the inner surface.

864,995. JUNCTION BOX COVER ROSETTE; Frank J. Russell, New York, N. Y. App. filed Oct. 20, 1906. A junction box comprising two independent insulating blocks which telescope together through a suitable opening in a supporting plate. The screws which constitute the fastening means also serve as electric terminals to make the connections.

865,011. CONNECTION SYSTEM FOR DIRECT-CURRENT ELECTRIC MOTORS; Raoul Brun, Havre, France. App. filed Feb. 28, 1906. A system in which a compound motor has a flywheel and booster mechanically coupled to the motor and having its armatures so connected to the supply circuit in series with the shunt winding of the motor as to reduce the shunt excitation with increasing loads.

865,013. RAILWAY BLOCK-SIGNAL SYSTEM; Winthrop M. Chapman, Needham, Mass. App. filed Jan. 24, 1906. Provides a signal system in which the signals cannot be improperly actuated under abnormal conditions, but which will be actuated with certainty under the usual traffic conditions.

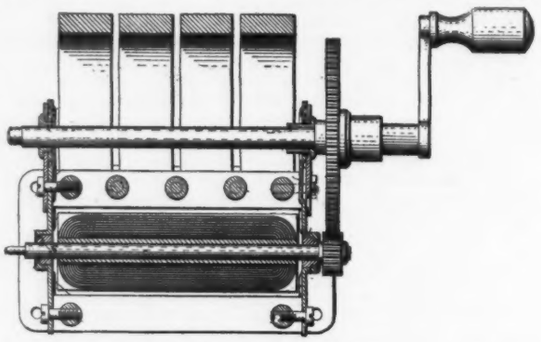
865,016. ELECTRIC FURNACE; Walter G. Clark, New York, N. Y. App. filed Dec. 17, 1906. An electric furnace having its walls of conducting material of relatively low resistance, and an internal heater or electrode arranged to contact at its lower end with the furnace walls, and being of less resistance at its end portions than at its intermediate portions and means for elevating the electrode.

865,027. APPARATUS FOR EXTRACTING MINERALS FROM ORE; Oscar A. Ellis, San Francisco, Cal. App. filed March 24, 1903. An apparatus for separating minerals from ores, comprising this hopper; an open launder provided with riffles and a precipitating box and a tank or vat, the precipitating box being shorter than the open launder, substantially as described.

865,038. WATER-TIGHT ELECTRIC BELL; Walter C. Hill, London, England. App. filed May 19, 1906. Relates to electrically actuated bells of alarms wherein the electric striking mechanism is enclosed within a water-tight metallic casing which forms the sounder or bell.

865,059. MEANS FOR ATTACHING PIGTAILS TO CARBON BRUSHES; Maxwell W. Robertson, New York, N. Y. App. filed April 29, 1907. The pigtail is clamped to the carbon brush by a pair of metallic plates which are disposed on opposite sides of the brush and rightly riveted together through the body thereof.

865,068. ELECTRIC GENERATOR; Klas Weman and Alfred Larsson, Buffalo, N. Y. App. filed May 21, 1906. An electric generator having two-pole pieces and supporting brackets for one of said pole pieces



865,068.—Electric Generator.

formed integrally therewith, each bracket having arms projecting laterally from the pole piece on opposite sides of its longitudinal center.

865,093. CURRENT TRANSFORMER; Oswaldo de Faris, Paris, France. App. filed Feb. 4, 1905. In an electrolytic transformer, a cell comprising a vessel of insulating material, a hollow carbon electrode within said vessel provided at its top and bottom only with horizontal series of perforations, a metallic electrode within said hollow electrode, and an electrolytic liquid contained in said vessel, the circulation of such liquid through the openings of said hollow electrode being identical with that which is produced in a thermo-siphon.

865,108. PRINTING TELEGRAPHY; Isidor Kitsee, Philadelphia, Pa. App. filed June 29, 1907. A feeding apparatus for the record sheet of a printing telegraph. Has a magnet actuating an escapement and which is energized by a polarized relay.

865,169. SIGNAL; Charles R. Dowler, Denver, Col. App. filed Sept. 12, 1906. A system for indicating dangerous conditions on a railroad comprising a weight buried in an embankment and connected to a semaphore apparatus, whereby the semaphore will be displayed when the embankment is washed away and the weight allowed to fall.

865,211. BINDING POST; Earl H. Rollinson, Albany, N. Y. App. filed Nov. 12, 1906. Binding post having a washer with laterally projecting ears which is clamped between the usual thumb nuts. The ears engage the wire to be clamped and prevent it from falling out in case the nuts loosen slightly.

865,215. ART OF TELEPHONY; Daniel M. Therrell, Charleston, S. C. App. filed July 23, 1904. In the art of the electrical transmission and reproduction of sound, means for producing resonance in the transmitter circuit, substantially as set forth.

865,219. END CONNECTION FOR CONDUCTORS ON FIELD MAGNETS OF ALTERNATE-CURRENT GENERATORS; Miles Walker, Hale, Altrinchham, England. App. filed July 13, 1907. Relates to features of construction of supporting three collector rings and making connections with terminals of winding.

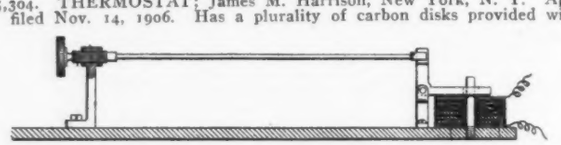
865,271. LONG BURNING ARC LAMP; Josef Rosemeyer, Lindenthal, Germany, and Gustave Dive, Bressoux, Belgium. App. filed March 7, 1905. Relates to long burning arc lamps and includes features of the clutch and feeding mechanism for the upper or positive carbon.

865,285. ELECTRIC SMELTING APPARATUS; James C. Young, Jersey City, N. J. App. filed Jan. 16, 1907. In an electric smelting apparatus, a carbon forming one pole and a series of spaced receptacles mounted for rotation in a vertical plane and forming the other pole, whereby an arc is adapted to be established or interrupted between said receptacles, one at a time, and the carbon, substantially as described.

865,291. LIGHTNING ARRESTER; William J. Bell, Deerfield, Wis. App. filed Sept. 26, 1906. Has an insulating base from which projects upward a carbon rod forming a ground connection. A metallic casing is supported by the base and extends closely alongside the carbon so as to establish a spark gap in connection therewith.

865,323. TROLLEY; Leslie S. Wilder, Northampton, Mass. App. filed Jan. 10, 1906. The trolley harp has a U-shaped frame hinged thereto to which are pivoted spring fingers. The arrangement is such that the fingers are yieldable downward and laterally in passing hangers, etc.

865,304. THERMOSTAT; James M. Harrison, New York, N. Y. App. filed Nov. 14, 1906. Has a plurality of carbon disks provided with



865,304.—Thermostat.

apertures, a pin extending through said apertures for supporting said carbon disks, and heat controlled mechanism for forcing said carbon disks together with varying degrees of pressure, thereby altering the resistance of the contact.

865,330. BATTERY; Reuben S. Clymer and Thomas M. Woodhouse, Allentown, Pa. App. filed Nov. 7, 1906. A medical apparatus including specially constructed terminal plates which are designed to be applied to the body of a patient so as to cause the absorption or injection of specified chemicals. One of the plates is in the form of an absorbent pad held against a metallic backing by binding wires. The other terminal is in the form of a sponge backed by a miniature lamp so as to elevate the temperature of the electrode in use.